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EDITORIAL NOTES.

The Request of the Ministry of Munitions.

GENERALLY speaking, local authorities throughout the country have taken in true patriotic spirit the request of the Ministry of Munitions that they should do "everything in "their power" to prevent attacks being made on gas undertakings, owing to any deterioration of the gas through the requirement for as much benzol and toluol as possible for the purpose of making the explosives that are essential to the victory of this country and its Allies. It was suggested that one form the protection should take should be by avoiding publicity of any infraction of statutory obligations as to illuminating power or calorific value by ceasing to test the gas, or by preventing the results of tests being made public. That is all. The local authorities are not asked to abstain from arraigning, or obtaining penalties against, gas undertakings for any infringement of their statutory qualitative obligations; the power of local authorities in this respect is suspended, where benzol and toluol extraction is proceeding, by the Ministry of Munitions under certain powers conferred by the Defence of the Realm Act, which may be exercised concurrently by the Minister of Munitions by virtue of the Ministry of Munitions Act. Neither is the permission of local authorities sought as to the recovery by gas undertakings of benzol, toluol, xylol, or other constituents from the gas. This is a matter in which duty, patriotism, and command, leave no choice to those controlling gas-works. And if compliance with the requirement of the Ministry of Munitions is not sufficient to yield an amplitude of the necessaries of which coal carbonization processes are the sources, then the Government have ways and means of compelling further compliance, just as they have found decisive means of doing other things that are requisite to the prosecution of the war. We are quite certain of this, that the public, almost to a man, would not, if informed of the facts, impose (if the power existed) any obstacle in the path of the performance of a service which is as essential to the carrying on of the war as men and money. We should hesitate to think, too, that there is anywhere in the country a local authority with a majority of members who object to do everything in their power to protect undertakings that are engaged upon such indispensable service for the nation as are gas-works at the present time. If there are any such men upon any of our local bodies in these days of national crisis, then they ought to be thoroughly ashamed of themselves, and their constituents ought to heap upon them the contempt they richly deserve. What the Ministry of Munitions is doing in this matter is being done under the Defence of the Realm Act—an Act that has very wide application.

Most urban authorities have complied with the request of the Ministry of Munitions to the extent of declining to raise even a particle of local suspicion by public reference to the communications. The matter has been treated wholly with judicious privacy. There are, so far as we have seen and heard, only isolated exceptions to this—Bristol and Wandsworth; and from both authorities, there has been publicity which should have been avoided in carrying out to the full the desire that everything possible should be done to protect the local gas undertakings from attacks. The Bristol Sanitary Committee especially is censurable; for if certain members had deliberately set themselves to start an agitation among the public, they could not have chosen a method that was better calculated to be effective. The Bristol public, however, we hope will appraise the action in a proper way, and will show their good sense by applauding rather than in trivial manner harassing a Company who have already extremely heavy burdens to bear in consequence of the war, and who are obtaining no material relief from those burdens in consequence of what they are doing to provide the nation with essentials to victory.

Both the Bristol Sanitary Committee and the Wandsworth Borough Council have decided to continue to test the gas; but the latter have resolved to do so fewer times, and at a proportionately less cost to the Council. There is no objection to this; the objection is to giving publicity to the matter—a publicity that has had large circulation through the daily and local newspapers, and even the "Commercial "Supplement" of the "Electrician" has gone out of its way to call attention to the matter. We protest strongly against this newspaper action, and hope that the Ministry of Munitions will take steps to prevent its recurrence. The Chairman of the Bristol Sanitary Committee (Alderman Lloyd) stated that he considered it was their duty to continue to test the gas. There is not the slightest harm in testing the gas for information purposes; harm could only come from any public use made of the results of the testings. But the use of such results to the detriment of the Gas Company would not have comfortable issues for those who are responsible. However, Alderman Lloyd went on to say (according to a report in a local paper) that the whole community would be affected; and the Committee would not be doing their duty unless they continued to test the gas. Supposing gas undertakings generally refused to comply with the request of the Ministry of Munitions to extract what is required for the making of explosives, supposing the Government had no power (which, of course, they have) to compel them to comply, it would be not only the community of the city of Bristol that would be affected, but the whole nation; and, instead of victory, national disaster would be the consequence. There is no question, from what has been already quoted and from what ensued, that one of the members of the Committee (Mr. Curtis) truly put the position when he expressed the opinion that some of his colleagues were approaching a national matter in a parochial spirit; and he demurred to the continuance of this attitude.

The most regrettable and objectionable feature of the attitude has yet to be referred to; for it is easy to see, from various remarks that were made, the end to which certain of the members of the Committee are driving. It is to the securing of a reduction in the price of gas in respect of any depreciation of quality that may result from working in the national interests as other gas undertakings are doing in all the big cities and towns, without any such paltry suggestion being made. If the Bristol Corporation had been owners of both gas and electricity works, and not of the electricity works only, nothing would have been heard of this matter, any more than it has been heard of in Manchester, Birmingham, or Leeds. However, Mr. Billing (according to the locally published report) said: "The quality of the gas "would be affected. They ought to get a reduction in "price." Is this what Mr. Billing calls complying with the request of the Ministry of Munitions, that everything possible should be done to protect the Gas Company from attacks in consequence of what they are doing for the nation? If so, we pity the narrowness of his interpretation of very plain words. He went further than that in making what we can only regard as indiscreet remarks which might have a bad effect on the public mind in some quarters—thus doing precisely what the Ministry of Munitions asked should not be done. The local report attributes to him the further words: "It was obvious that, if certain things were "taken out of the gas which reduced its effectiveness, the "consumers should receive some compensation." Later on, too, he gave notice of this motion: "This Committee "are anxious to adopt the suggestion of the Government as "to altering the quality and present mode of gas supply, "and would ask the Gas Company to supply the Committee "with information as to the effect of the alteration in cost, "heating, and lighting standards for consideration at the "next meeting of the Works Sub-Committee." Reading these various remarks, we cannot avoid the impression that Mr. Billing's anxiety to "adopt" what the Government are

requiring in respect of benzol and toluol extraction was not extended to their request that he, as a unit of the Bristol City Council, should do his part in protecting the Gas Company from attacks. Such protection is not to be promoted by remarks such as he made, and which found their way into the local papers. However, it so happens that the Government are "top-dogs" in this matter, and not the Sanitary Committee of the Bristol Corporation.

Apart from the patriotic interest of the public, as a matter of fact the gas consumers will be but moderately affected in respect of quality. Mr. Billing seems to have wholly prejudged the matter without possessing any very definite knowledge concerning it. The communication from the Ministry of Munitions appears to have aroused in his mind the view that something really bad was going to result to the gas supply. Let us repeat his words as reported: "It "was obvious that, if certain things were taken out of the "gas which reduced its effectiveness, consumers should re-"ceive some compensation." The communication from the Ministry of Munitions was not intended to have the effect of giving an idea that something serious was going to occur to the quality of the gas; it was intended to protect the gas undertakings against any uncomfortable consequences from any fortuitous lapses below standard, and to give them confidence in working for as large a yield as possible of what our Army and Navy now so urgently require. The only consumers of gas who may notice a difference are the antiquated folk who in these times use uneconomical and inefficient flat-flame burners. The percentage effect of the recovery process upon the calorific power of the gas being small, all other users for all other purposes will not appreciate that there is any difference in the gas. Gas companies are paying a heavy price for their coal, oil, and other materials, pitch is practically unsaleable, the light oils of tar are in good demand, but the balance is not going off so freely as gas undertakings could desire. Lighting consumption is hindered. They have their increased financial responsibility in respect of taxes, and higher charges for labour. In many other ways, they are affected by the war. Amid all this, and while helping to meet a national emergency, there comes the claim that if thereby the quality of the gas is reduced there ought to be compensation. The Government are paying moderately for toluol; but, if it were not for their patriotism, and the requirement of a power that cannot be refused, there are some gas undertakings that would be better off by not working the process.

These are unusual times; and let those who are members of local authorities take a broad view, and treat them as such. Thank goodness for the national spirit that almost generally prevails among them.

The Conversion of the Thriftless Worker.

THE financial and economic position of the country, and the need for national economy, are subjects that are riding high in the minds of thoughtful people. They have formed the topic of numerous newspaper and magazine articles, and for many speeches in the House of Commons and from the platform. They also supplied the entire composition of the speeches of three Cabinet Ministers at a meeting, last Wednesday, of a thousand leading representatives of trade unions and other societies, with an aggregate membership of four millions. The objects of the speeches were to urge greater economy upon the workers of the country, to enjoin them, in the interests of the State and of the poorest sections of the community, to abstain from asking for further increases of wages during the war, and to appeal to them to save, and to devote by investment their savings towards helping the country in these times of enormous financial pressure. The lines and substance of the appeals were good; but they conclusively showed that the Government understand the working classes of this country just about as much as they understood and realized the need for an abundance of high explosives before the country embarked on this war. They do not know the working classes, and they do not appreciate the needs to make of them generally better citizens through thrift, and to induce them to put forth greater effort to help in the economic work of the nation.

What the Government are seeking to do is to suddenly revolutionize the habits of the wage-earning classes. In this they have a serious and difficult task, which will not be so speedily accomplished as they could wish. The gas industry is a large employer of labour; and the gas industry knows from experience that the notions of the Government as to producing among workers immediate economy and savings, and the putting of the money, by investment, at the disposal of the country, are doomed to failure. The working classes have their own modes of life, just as have other classes. There are well-paid workers; there are those who are miserably paid; and between the extremes are the others. There are well educated and highly respectable people at all the wage-earning levels; even among the most poorly paid they are to be found. On the other hand, among the best paid, there are those who in their homes have lived at the rate of the most poorly paid and have squandered the rest; and among the poorly paid a large proportion have found it difficult to make both ends meet. The more intelligent and respectable section—good and poorly paid alike—are those who have put any money they could spare in the Post Office Savings Bank or other institutions which have been founded with a view to promoting providence among them. These are the people, too, who made the largest subscription through the Post Office to the War Loan, and the total of which subscription did not come up to the expectation of the Government. The habits of the people arising from these conditions are not going to be changed by any trumpet call, even though the trumpet be sounded by Cabinet Ministers. The squanderers will go on squandering; and those who have hitherto been wretchedly paid—even though they be of the 4½ millions, or about one-third of the total number—of workers who have had an average of (say) 3s. 6d. per week war bonus added to their earnings—will feel the pinch still greater, with the cost of living some 30 per cent. higher. There are those workers, too, who are receiving much more in total wages owing to the pressure in munitions factories; but many of these and their families are living up to their new-born opulence. These are the people who should be first approached with a view to economy and to saving, and the placing of money through investment at the disposal of the State. A revolution in their habits and inclinations, however, cannot be produced at command; and the same with the less fortunate of the working class part of the population. What the Government are asking them to do, a large proportion do not as yet understand; nor will they appreciate as applying to them a salient point in the speech made by Mr. Asquith to the trade union leaders: "Any excess either of profits or "wages which does not find its way back to the State in "loans or taxes, or is not employed in necessary industries "and public services is so much loss to the national "revenue and national resources, and therefore so much "injury to the national cause."

Whose fault is it—in no small part—that there is not appreciation and practice of economy and thrift more largely among the well-paid part of the working classes, and that there is an unpreparedness among them to assist the State financially in the present crisis? The Government, who have not hitherto bestirred themselves in any way to give proper encouragement to workers to save and create a larger independence for themselves, now suddenly exhort them to promptly change their habits, and to save and to lend the money to the State. There has been no Governmental preparation for this in times of peace; and now, in the time of war, there is no likelihood of producing a sudden conversion. Mr. Asquith, Mr. M'Kenna, and Mr. Runciman have no cause to preach to the already thrifty workers. Their savings have long been at the disposal of the Government; and there would have been much more if the Government had years ago taken in hand the creation and promotion of thrift generally among the working classes, by giving them the opportunity to invest money safely and secure a better return than is to be realized by money deposited in the Post Office Savings Bank—a return giving on their savings the same encouraging interest that the man of greater affluence can get for his money in safe securities. For this lack of past encouragement, the Government must blame themselves; if there is not a ready response to their present appeal, they must attribute it to their own short-sightedness. They have spent no end of time and money on social legislation. In connection with the country's workers, there outstand the Employers' Liability and Compensation Acts, the Old Age Pensions Act, the Mines Eight Hours Act, and the Health and Unemployment Insurance Act, in regard to the working of which last-named there is now to be inquiry. But they have neglected all plans seriously to promote thrift, and an ambition among workers to become owners of capital. The Government have been asked time after time to help forward the co-partnership movement, but they have remained list-

less, preferring to spend time on their own pet schemes, which are not helping in the present emergency. The neglect is coming home to roost, just when financial help by every section of the public is urgently required.

The proof of the inappreciation of the Government as to the futility of urging prompt conversion to thrift and investment lies in the appeal itself. Co-partnership (not simple profit-sharing) is an educational and encouraging scheme to the succeeding ends of economy, saving, and investment. But the South Metropolitan Company—the pioneers of co-partnership in the gas industry—could tell the Government that its educational work was not accomplished and did not bear fruit in a day. Platform utterances, and circulation of prints of speeches, did not produce present achievement; but years of steady, plodding work (often the results were disheartening), and the encouragement given to the men by the inherent virtues of the scheme, were essential. The work and encouragement eventually bore good fruit. Increasing numbers of workmen left the whole of their bonus with the Company, for the purpose of buying stock; the possession of a small amount of stock (on which the same dividend is paid as is received by the largest investor in the Company) created the desire among many of the men to own still more, and private savings were soon finding their way to supplement bonuses, in order to help to hasten the next purchase of stock, and the securing of more dividend. Nothing better we think could be produced than the experience with co-partnership to show the Government that there is little likelihood of the realization of their hopes as to the sudden conversion of the habits of that section of workers among which exist uneconomy and waste, so as to put them in the position to assist in succouring national finance in these days of stress. Much time for education is required, encouragement must be given, and first results would then yield their subsequent increase. The history of the development of co-partnership would have to be repeated. If hereafter there is ground in the meagreness of the response for disappointment on the part of the Government, then they must blame themselves for putting off to the day of necessity the recognition of their lost opportunities among the working classes in times of peace, when the important facilitating condition existed that living cost less than it does now.

Technical Development of the Coke-Oven Industry.

Publication is made in our columns to-day of the complete text of the Presidential Address of Mr. George Chrisp, of the Dalton Main Colliery, to the members of the Coke-Oven Managers Association, whose first meeting was reported in our issue for Nov. 16, and commented upon in that for Nov. 23. The address was peculiarly appropriate to the inaugural occasion, in that it traced the road along which the coke-oven industry has technically developed. It has been a long road; but in the last three decades the pace of development has been so accelerated that the position to-day is a notable one, and affords an excellent basis for the building-up of still greater perfection. Above all, it is clear the beehive oven must go. Mr. Chrisp referred to the difficulties that have been experienced in this country in changing from the beehive to the bye-product plants. These difficulties have been largely due to the users of the coke, who have continued to entertain an unaccountable fancy for the product of the old oven as compared with that of the newer type—"unaccountable" when all the facts are taken into consideration. Where bye-product coke is properly made, there is no substantial chemical difference between it and coke of the beehive process; and proof that the qualities of iron and steel are not deteriorated by the use of bye-product coke is found in its use by many of the iron and steel manufacturers of front-line reputation. Any difference that does exist is due mostly to the variation in the composition of the coals carbonized. But Mr. Chrisp says it is incontrovertible that, treating the same coal by the two processes, the old system produces coke containing less ash than the new system. But coal washing has come to the aid of the bye-product oven in this connection; and washing is not an expensive operation—2½d. per ton is a figure that has been quoted. Now where properly supervised bye-product ovens work in conjunction with auxiliary plant contributing to the improvement of the coke, and a good variety of coal is used, there is no reason why the most hardened upholder of the beehive product should not be converted, and have his bias removed. The President acknowledges what no one can deny, that the beehive plant is wasteful, and that the difference between the coke of that and the bye-product plants is insufficient to justify the perpetuation of the waste. Of course, the President does not pretend his address is complete as a review of the history of the coking industry. The industry is too vast, its processes too important, and its technical and commercial ramifications too great for its history to be compressed into the length of a presidential deliverance. There is much more to be said than Mr. Chrisp had time to say; but it makes a good summary of technical progress to be able to point, in the result, to the production of good class metallurgical coke, to the ability to utilize inferior coal, to higher yields, to economy of labour, and to the rescue of valuable materials from the lamentable waste that formerly proceeded. Yet how much there is yet to be done to attain maximum efficiency!

An Imposing Inquiry Circular.

The circular-inquiry nuisance is one of those things that will in all probability have eternal life, with occasional dormancy. The reason for this view is that we cannot imagine such a blessed time being in store as when the picker of other men's brains by this means, and when people who are incapable of forming judgment for themselves, will cease to exist. The pest, however, allows relief for a time by remaining dormant; his consideration in this respect being due not to choice, but to the then current bad odour in which the practice stands through the antagonism aroused by its rather extended exercise. There has been a revival of the trouble of late. We have had the Stoke-on-Trent Corporation and the Slough Gas Company attempting to pry into the rates of pay of gas engineers and managers in other towns, as though, as in the case of unskilled labour in a district, there was a market rate for official services, varying only according to the conditions and output of works, without taking into account talent, capacity, or anything else. From Huddersfield, too, there was sent an inquiry circular regarding public lighting; and now, on the same subject, there emanates from Margate a circular which must about have taken away the health of recipients. It is hoped those who received the circular (which was in length about as unreasonable as any we have seen, as well as in regard to the nature of the questions) did not trouble to answer the 31 inquiries. The substantial missive, which was signed by the Borough Surveyor of Margate, seems to have had an extensive circulation—anyway correspondence indicates this, as well as the fact that the covering letter was printed. In the latter, the Borough Surveyor stated that he had been instructed to prepare a report on the cost of lighting the borough; and it appears that his inquiries were put so as to enable him to make a comprehensive job in response to his instructions.

Quite one-half to two-thirds of the questions, however, were not pertinent to the subject of the lighting of Margate. How conditions of places scattered over England could bear upon the question of the lighting of a popular seaside resort is beyond our comprehension. What, too, has the sixth inquiry—"Candle Power of the Gas?"—got to do with lighting by incandescent burners? The question as to the average distance between lamps (question No. 9) is one which can best be decided by the money that the local authority are prepared to spend on the street lighting, the degree of illumination required, and therefore the size of the burners that must be employed. Margate ought to be particularly well lighted in normal times; and the average distance between the gas-lamps ought not in any way to be controlled by what is done in other places, but by local need and interest. The inquirer also desires to know the type of burner (upright or inverted) the recipient of his inquiries prefers—and why? Has not the Borough Surveyor a preference of his own? If he has, he ought to be in a position to put reasons to the preferences of others; if he cannot do so, then he does not know much about the relative merits or demerits of the two forms of burner named. Information is asked as to the consumption of gas; and the fifteenth question is: "How measured?" The inquiry is made as to "Cost per foot run of service in road?" But the crowded sheet of interrogations does not leave room for a statement as to the conditions under which the service is run. Another question is, What is the average life of service in road? The Borough Surveyor has neglected to ask how the service is laid, and the character of the subsoil. So the

inquiries proceed; and if the person replying is not tired by the time he reaches the thirty-first, the Borough Surveyor gives him further latitude to say what he likes, and as much as he likes, under the heading No. 32 "General Remarks." This is where the sole reply to the circular should appear. Perhaps in some cases, though the 31 questions are left unanswered, some "general remarks" will be made. If so, they may be found more forcible than polite. This would not be astonishing; and we should not be disposed, under the circumstances, to say that the "remarks" were in the slightest blameworthy.

The Flight of Freights.

In the editorial article in last week's issue regarding the upward flight that freights had again made, the position was exemplified by reference to the rates from the Tyne to London, and the considerable influence that they were having upon the financial and business conditions of gas undertakings. We are pleased to see that the "Iron and Coal Trades Review" (although not specifically mentioning the "JOURNAL") endorses our views in respect to this particular matter. The situation during the past week has become worse instead of better; and not only in regard to coastwise trade, but in relation to foreign business. Our Allies must be suffering immensely from the extraordinary height to which freights have been run; and so must gas undertakings abroad (both near and far) that rely upon British coal. The rate of freight from the Tyne to London last week reached 15s. and 16s. per ton; and freights for more distant ports have proceeded to figures that are beyond reproach if audacity and greed are virtues. The matter is producing genuine alarm among those who see in this condition, if it is not arrested with a firm hand by the Government, a serious menace to our overseas trade; and it is not to the country's interest that export business should be jeopardized in this way, nor that necessary imported goods should be, through this cause, raised against us tremendously in cost. This is what the "Iron and Coal Trades Review" says: "It is true, of course, that in view of our colossal war expenditure, and the needs of the Government, the prosperity of the British shipping industry is welcome; but when the prosperity exceeds all reasonable limits, and encroaches upon the welfare of other branches of business activity, it naturally calls for serious notice." Circumstances alter cases. The circumstance that it is the British shipping industry and not the coal industry about which our contemporary is writing, causes it to see things in a totally different light. If someone had told us that at some time or other we had, in connection with our comments on the coal industry, written the latter of the quoted words, we should not have been prepared to dispute the allegation.

Flaws in Statutory Control.

Though our contemporary does not apply these words to the coalowners, it does in effect proceed to boast that finesse on their part has not been killed by legislation. For instance, the steps taken to control prices in the coal trade have not, it says, realized all the hopes of the authorities. One consequence of these steps is "that supplies are naturally gravitating towards the centres where the best prices are obtainable under the Limitation Act, with the result that other localities are inadequately provided for, as in the case of London." Then, again, "the check put upon the foreign trade in order to prevent unduly large quantities going abroad, in view of the absence of any control of export prices, has not always had the full effect desired." Those who handle coal will not be at all obliged to the "Review" for pointing out flaws in statutory control, which flaws enable them to reap some uncontemplated advantage. Mentioning exports admits of further reference to the supply of British coal to Holland. There has been prior mention of the working of the Kolenbureau, to the control exercised over its operations by representatives of the Westphalian Coal Syndicate, and to the effect of this control on British trading in coal with Holland. Our contemporary states that the latest phase of this business is that a list of Dutch importers approved by the British Government is understood to be in course of preparation, and those within the fold of the Bureau are to be released; it being a condition of our continued export of coal to Holland that none from this country shall be distributed by the Bureau. Thus the British coal trade with the Netherlands appears to have been freed from German chains.

OBITUARY: HENRY O'CONNOR.

By the death of Lieutenant-Colonel Henry O'Connor, there has been removed another well-known member of the gas engineering profession, and one whose place will not be easily filled. Naturally, his loss will be most felt in Scotland, where he lived; but, at the same time, his influence was of a character which made itself felt over a much wider field. Those who knew him personally—and they were many—were all his friends; while his literary activities had won him the good opinions of an even larger circle than this. As a gas engineer, and as a writer and speaker on gas engineering subjects, he was for many years well known; and he was also for a long period prominently connected with the Volunteer and Territorial movement. All too soon—at the comparatively early age of 53—death has removed him from us; the end, which came last Wednesday morning, after a short period of illness, being ascribed to heart affection. The call of his country found him ready—even eager—to respond; and the devotion, the whole-heartedness, with which ever since the outbreak of war he performed the exacting military duties devolving upon him, was maintained, until at last his health broke down.

It was during the time when he was professionally engaged in India that Lieutenant-Colonel O'Connor (V.D.) received his first Commission as lieutenant in the Bombay Garrison Artillery Volunteers. On his return to this country, he joined the City of London Royal Garrison Artillery (V.), and later the City of Edinburgh Volunteer Artillery. He had attained the rank of Captain before 1908; and in that year, when the Forth Royal Garrison Artillery was started, he was promoted to Major. In 1907, the Volunteer Decoration was conferred upon him; and five years later, on the retirement of Lieutenant-Colonel J. M'Niel (V.D.), he was promoted to the Command of the Forth Royal Garrison Artillery. On the outbreak of war, his corps was mobilized; and he was on practically continuous duty with it until his breakdown at Carlingnose Military Hospital.

The deceased gentleman was the son of the late Mr. John O'Connor, R.I., A.R.R.A., a well-known painter and scenic artist of his time, and was himself a capable draughtsman and one of the mainstays of amateur dramatic art in Edinburgh. Although he seldom acted himself, he was an admirable stage manager; while Mrs. O'Connor was an amateur actress of outstanding distinction, until she was stricken by illness some five years ago. Lieutenant-Colonel O'Connor received his education in London and France. He was a student under Professor A. B. W. Kennedy at University College, London, and afterwards under Professor Henry Adams, at the City of London College. Having thus studied engineering, he became a pupil of Mr. (now Sir) Corbet Woodall at the Vauxhall works of the Phœnix Gas Company. On the subsequent amalgamation of the Phœnix and South Metropolitan Gas Companies, he entered the service of the latter Company, under the late Sir George Livesey, as an Assistant Engineer. The next professional engagement he secured was in India; a period of five years being spent as Assistant Engineer and Manager of the Bombay Gas Company. While there, he was appointed one of the engineering professors at the newly-formed Technical College, and was elected a Director of the Sassoon Mechanical Institute. It was, as already remarked, while in India that he first began to take an interest, destined to be life-long, in the Volunteers. Returning to England, he took up a position as Resident Constructing Engineer at the Beckton works of the Gas Light and Coke Company, under the late Mr. G. C. Trewby.

It was in 1895 that our friend went to reside in Edinburgh; for it was then that he left Beckton to join the firm of James Milne and Sons, Limited, where he had charge of the Gas Engineering Department. This connection lasted until 1908, when he relinquished the position to take up private practice as a Consulting Civil Engineer. In this way, he was able to be of much assistance to the gas industry in Scotland, his advice being frequently sought. One of the last professional engagements referred to in the Press in connection with which he figured prominently was the arbitration held to determine the price to be paid for the undertaking of the Bridge of Allan Gas Company. The hearing took place late in 1913; and he gave evidence on behalf of the Company.

To his capacity as a writer on technical matters, the pages of the "JOURNAL" at intervals over a space of many years bear eloquent testimony; and he was the author of several books. Perhaps the best known of these was his "Gas Engineer's Pocket-Book." Another one was on "Petrol Air Gas;" and he also was part author of Hughes and O'Connor on "Gas and Gas-Works." Among much other work, he was lecturer at the Heriot-Watt and Glasgow Technical Colleges on subjects connected with gas; and he was instrumental in founding the Eastern Section of the Scottish Junior Gas Association. At many technical meetings in England, Scotland, and Ireland, indeed, he will be sadly missed. Quite recently he was at the meeting of the North British Association of Gas Managers, and a few years ago lectured on the "Inverted Incandescent Burner" before the Irish Association of Gas Managers; while he was a Past-President of the Society of Engineers, an associate member of the Institution of Civil Engineers, and a Fellow of the Royal Society of Edinburgh. Of the numerous papers he read and lectures he delivered before these and other bodies, it is unnecessary to say more than that they were always helpful, and always enjoyable; for he had a happy style, which held the attention of his audience.

The funeral on Saturday was a military one; the burial being in Warriston Cemetery.

PERSONAL.

Mr. ALEXANDER CURRIE, Assistant Gas Manager at Campbeltown, has been appointed to the managership of the gas undertaking, to succeed his father the late Mr. Dugald Currie.

Mr. W. WALTON, of Emsworth, has been appointed Manager of the Bradford-on-Avon Gas-Works. He obtained his training at Portsmouth, where he was for fourteen years, and has been in his present position for the last six years.

Mr. V. E. CHANDLER (second son of Mr. Samuel Chandler, and brother to Mr. S. B. Chandler, the President of the London and Southern District Junior Gas Association) has just been gazetted Second Lieutenant in the Royal Field Artillery. He was previously a Sergeant in the City of London Yeomanry.

Mr. L. W. NUTTALL, Manager of the Gosport Gas-Works, has been appointed Gas and Water Manager at Goole, at a salary of £300 per annum. Mr. Nuttall has been at Gosport for the past nine years, prior to which he was connected with the Keighley Corporation Gas-Works for three years. He served his apprenticeship under the Darwen Corporation. There were fifty applications for the Goole post.

Mr. J. W. BROWN, who some two years ago was appointed Manager of the Bridgetown Gas-Works, Barbados (West Indies), has left his position there, and returned to England with the intention of serving his country; and he is hoping to secure a Commission. Before going to Barbados, during the absence of Mr. W. Arnott, the Manager at the Cape of the South African Lighting Association, he took charge of the works there.

An announcement appeared in the "JOURNAL" quite early this year, to the effect that, owing to continued ill-health, Mr. JABEZ LIGHT had retired from the Board of the South Suburban Gas Company, of which he had been a member for more than thirteen years, during six of which he occupied the position of Deputy-Chairman. Unhappily, Mr. Light has not long survived the retirement; for he died on the 1st inst., at East Croydon, in his 79th year. The funeral was fixed to take place yesterday, at Norwood Cemetery.

Mr. ARTHUR R. GRIGGS, who has for some time been on the staff of the South Suburban Gas Company, has been granted a commission in the Royal Naval Air Service—thus realizing a wish he has long entertained. He is busy now at the Admiralty, and expects to proceed to the Eastern theatre of war in about a month. This announcement will possess a twofold interest for the members of the London and Southern District Junior Gas Association. Their best wishes will follow him in his new work; and at the same time they will regret the loss of the paper which he had promised to read during the current session.

It was mentioned in the "JOURNAL" some weeks ago that Corporal JOHN HOLLIDAY, R.E. (formerly Gas Engineer at Scarborough, and later at Hull), who had been wounded in France, was in the American War Hospital at Paignton. It is gratifying to learn that he is recovering, and is already looking forward to returning to his old section at the front. Corporal Holliday is at present in the Totnes Voluntary Aid Detachment Hospital, the first anniversary of the opening of which was celebrated last Wednesday. The event was marked by a social gathering, in the course of which Corporal Holliday asked the Commandant (Dr. W. Chapman) to accept from the soldiers at present under treatment in the hospital a silver cigarette case, as a small token of the deep respect in which they held him, and the esteemed Matron (Sister Tregaskis) a silver photo frame and a bunch of Christmas roses, as a memento of the deep regard of her "boys."

A pleasing ceremony was recently carried out in the retort-house at the Gillingham Gas-Works, when Mr. CHARLES TANNER, Senior Superintendent (who is retiring owing to ill-health), was presented with a canteen of cutlery, and Mrs. Tanner with a pair of silver flower vases, by the staff and workmen. The Engineer (Mr. C. Valon Bennett), who made the presentation, paid a hearty tribute to Mr. Tanner's services to the Gas Company, and his cordial relations with the workmen, and hoped that he would live for many years, and have better health. Mr. Tanner responded with a few well-chosen remarks, saying it almost overwhelmed him to think that he had such a lot of friends around him, as was evidenced by the beautiful presents. He took this opportunity to thank one and all for their kindness. He would look on the present as a token of the high esteem in which he was held by all employed at the Gillingham Gas-Works.

City of London Gas Examinership.

At a meeting of the Court of Common Council of the City Corporation last Thursday, a report was submitted by the General Purposes Committee upon the nature, duties, and emoluments of the position of Chief Gas Examiner, rendered vacant by the death of Professor Vivian B. Lewes. The recommendation of the Committee was that the office be not filled, and that an expert adviser be retained for gas purposes at a remuneration of fifty guineas per annum. The Committee also recommended that the salary of Mr. W. W. Duffield (the Senior of the three Assistant Gas Examiners) be increased to £260 per annum, on condition that, in addition to his duties as a gas examiner, he conducts the work of the office in Whitecross Street, and that the increase shall not count for pension when he retires. The recommendations of the Committee were adopted without discussion.

ELECTRICITY SUPPLY MEMORANDA.

THOSE lazy electricians who have not troubled to take stock of electrical affairs for themselves have been provided in the Inaugural Address of the new President of the Institution of Electrical Engineers (Mr. C. P. Sparks) with a review of the past and present position, and with a forecast as to the lines of possible development. There is little that is new in the deliverance; but, being President of the Institution, the composition has *ex cathedrâ* rank, and so claims consideration. Mr. Sparks tells us what is ancient history, that the electrical industry started in this country on unsound lines; that it was an initial mistake to subdivide the Metropolitan area between so many supply authorities; and that through this the present situation cannot be considered entirely from the engineering point of view. The President sketched the fruitless efforts that have been made to get parliamentary sanction to put electricity supply in the Metropolis on a saner basis, though truth to tell there is not a great difference between the average costs at which service is rendered to electricity users in London and in those cities and towns where large central power stations exist. Still nobody denies that things could be improved; and Mr. Sparks is a decided moderate—and properly so—in his views as to what should be done. Of prime importance (this comes before price) is reliability of supply. When considering this, the President is against too great concentration of generating plant, but argues in favour of fewer stations than at present exist, which number 38. He evidently believes in inter-connection of the stations being the starting-point of reformation, with a power station to supplement the supply from the existing stations, and as the less efficient of these pass gradually out of use, the main power station could be supplemented by a second or further stations as required. The President points to the principal inventions that have resulted in improving the reliability of supply, and in promoting efficiency and economy. The development of the steam-turbine, and the adoption of superheated steam, and suitable condensing facilities have entirely changed the character of supply undertakings. These changes have enlarged their scope by increasing the possible size of operating units, have greatly reduced the first cost of generating and boiler-house plant and buildings, and have lowered operating costs. In connection with the distribution system, the President awards Mr. Ferranti a large measure of praise for his invention and the development of paper-insulated lead-covered cables, which have not only reduced the cost of transmission and distribution, but have largely increased the reliability of operation. When it is considered that some 40 per cent. of the capital outlay in the electric-supply business is due to distribution, of which the cost of cable represents the greater proportion, the importance of the development is apparent. All the statements as to plant improvement, of course, constitute good reading for the central station engineer who has not the points already well in his mental grasp. Mr. Sparks also makes reference to the progress in utilization. Alluding to the nitrogen-filled, or so-called "half-watt," lamp, he states that by it 2000 candle-power-hours are obtainable per unit, which declaration is clear proof that the President has not photometrically tested these lamps. Then regarding motors, he admits that with them little further improvement in efficiency can be expected; seeing that with motors of moderate power, speed, and voltage, the efficiency already reaches 85 per cent. The main efforts of designers have been devoted to reducing the weight, and thus lowering the first cost, which has fallen 50 per cent. in motors of moderate size during the last fifteen years. The other directions of motor advance have been in improved reliability and reducing the cost of maintenance.

Progress in Efficiency and Economy.

Further Expansion of General Supply.

There are, in the President's view, four main reasons why a "large further increase" in the general supply should be anticipated, apart from the extension of electric traction, and the use of electrical energy for electro-chemical purposes. These reasons are: (1) Necessity for fuel economy; (2) extension of lighting; (3) increased range of transmission; (4) domestic use of electricity. In this connection, the President, while desiring to be taken seriously, really gets rather humorous. In respect of national fuel economy, he thinks that the centralized supply of power and heat is the way to the desired end. We agree; but it depends upon the nature of the centralized supply. His idea of attaining economy is by converting the heat energy of coal into electricity. It may be submitted that there is another form of centralized supply by means of which a greater proportion of the heat energy of the coal can be placed at the disposal of users than by first converting it into electricity. If Mr. Sparks does not know of this other way, we shall be pleased to inform him. Then he goes on to suggest that the gas-firing of boilers at generating stations will be the next step in advance; the gas being obtained from producers worked at low temperatures. This system will provide bye-products [plural] from the distillation of the coal as a raw material [singular] for other industries. But he suggests that most of the present power stations prevent this system being worked, as bye-product processes can only be successfully operated on a large scale, and with plant working at a high load factor. We suggest that these electricity generating

stations would clearly be subscribing to national fuel economy by using gas coke instead of raw coal under their boilers. Then follows the absurd comparison as to candle-power-hours derived from a ton of coal used at an electricity generating station and from the gas obtained from a ton of coal carbonized at a gas-works. This was a point that was dealt with in the "JOURNAL" last week [p. 473], and sufficient was said in regard to it. As to the increased range of transmission, the President thinks that further research should allow of higher working pressures for underground cables; and that overhead lines should enable current to be more cheaply distributed outside the range of thickly populated districts.

Electric Cooking Prospects.

There is nothing that is fresh in all this as to the prospects of development for the electrical industry. It is all commonplace. But we come to where the vista is at first a pleasant one for the President. He looks at it with keen enjoyment, and then suddenly puts obscuring clouds between himself and the view. In his judgment, there is no section of general supply that opens up greater possibilities than electric cooking and heating, since, at a modest estimate, the units required would be ten times those needed for lighting! But earlier in the address, Mr. Sparks admits that 40 per cent. of the capital expenditure is absorbed in the distribution system; and later on he confesses that a low charge is essential for these purposes. The two conditions are opposed, and yet he says the low rate is justified by the high diversity factor and the large number of hours of use, resulting in a greatly improved load factor from the residential demand. If the men of the electrical industry would only take account of the large experiences of the gas-supply industry, and not imagine so much upon their own limited experience, it would be found that the demand for cooking is of a character that means peak loads at definite hours of the day, and that the demand for heating is as erratic during the winter season as are atmospheric temperatures. For the electrical industry without storage, this class of business is not all so pleasant as the President pictures for his own satisfaction and that of his professional colleagues. He does not acknowledge these drawbacks; but he does others. While, he remarks, the efficiency of conversion in the present electrical apparatus is high, and the system is an ideal one hygienically—"since there are no products of combustion"—development has been slow. And first of all, we should like Mr. Sparks to tell us what is wrong with the products of combustion in the system that is the most popular of any for cooking and general kitchen use. Are they chemically wrong? And has the use of gas-cooked food had any deleterious effect upon the health of not only this nation, but of all the nations of the world? He goes on to explain why the electrical development in these lines has been slow. Foremost he puts this: "With the present method of conversion of the heat energy in the coal to electricity, it is only possible to deliver to consumers some 15 per cent. of the heat energy in the coal." Yet earlier in the address we have the President advocating centralized heat supply by means of electricity in order to contribute to national fuel economy! Personal predilections and interests are apt to distort judgment, and occasionally, as in the case of Mr. Sparks in this instance, cause arguments to act destructively one upon the other. But the acknowledged tremendous loss of heat energy is not the only barrier to the rapid adoption of electric cooking and heating. The President finds the cost of the apparatus and its maintenance are obstacles. He believes, however, there will be improvement in these respects as soon as supply undertakings are prepared to let on hire and maintain apparatus on liberal terms, in the same way as the motor business was developed. There is little analogy between domestic cooking and heating and the motor—the conditions of use being altogether different. But to sum up. The apparatus, though costly initially and for maintenance, must be supplied on hire (including upkeep) on liberal terms; the energy must be supplied at low cost; and, if use succeeded in reaching large dimensions, the demand on the distributing system would be piled-up for cooking during certain hours of the day, and for heating on the low-temperature days of winter, which intermittent form of demand would increase both plant and distribution expenses. The commercial position does not look so bright when the technical and financial factors are examined in all their bearings. Without such examination, self-deception is very easy indeed.

Electric-Fires and Cold Weather.

We learn from "Electrical Engineering" that Mr. George Wilkinson, the Borough Electrical Engineer of Harrogate, has issued a booklet dilating on the advantages of electricity in the home. The benefits of the rateable value system—a fixed charge of 15 per cent. on rateable value, and ½d. per unit for all electricity consumed—are lauded; and consumers are informed that for water heating and like apparatus (having 100 per cent. load factor! with automatic control), current is supplied on contract at ⅓d. per unit. The information then proceeds: "As showing the advantages of the tariff, an example is given of a house in Harrogate let at £60 per annum. In 1913 the kitchen range and boiler were removed, and the house was equipped as an 'electric household' as follows: Complete kitchen arrangement, including electric cooker and automatic electric hot-water apparatus capable of furnishing a maximum of 125 gallons of hot water (at 100° Fahr.) in 24 hours. Eight rooms were fitted with plugs for electric-fires, including four bedrooms and the bathroom. One fixed and three portable radiators were provided, as well as plugs for an electric vacuum cleaner on each floor. For supplementary heating in the cold weather, a slow combustion coke-boiler was installed in the basement, and hot-water radiators fixed in the entrance and rooms on the ground and first floors. In the coldest weather, coal fires in slow combustion grates are used in place of the electric-fires in the living rooms. These labour-saving improvements allowed of one maid being dispensed with, and the actual comparative expense, taking the average of two years, on the rateable tariff, showed a saving of £10 16s. 9d. per annum." There are two points of interest about this statement. The first is that in cold weather a slow combustion coke-boiler and slow combustion coal-grates are used. This is splendid testimony to the incapacity of the electric heating method to cope with the conditions when heat is most required. We have heard a lot lately from unhygienic people about constructing houses without flues so as to favour the electric "fire." The members of this "electric household" could not manage without chimneys in the perishing days of winter. Regarding the saving of £10 16s. 9d., it will be noted that the services of one maid were dispensed with; so that when the coal fires are in use, additional work must be thrown on the remainder of the household through the absence of the one servant. This is something like Mr. Wilkinson doing without a full staff at his station at the time of maximum winter work. The "saving" is shown by a table given in the "Electrical Times" to have been due entirely to the eviction of the servant girl; and that her expense went to contribute to defraying the higher costs of the electrical methods. This means that where there is not a maid who can be shown the front door, the electrical methods stand no chance. The comparison is as follows:

One maid less	£20	0	0	15 per cent. on rateable value (£45) ..	£6	15	0
Food and maintenance	20	0	0	11,334 units at ½d. ..	23	12	3
Saving in fuel (16 weeks) at 4s. per week..	3	4	0		£30	7	3
				Upkeep and repairs, say	2	0	0
	£43	4	0		£32	7	3

For the edification of the general public, this comparison is not as explicit or detailed as it might be.

The Artful Fatherland.

We have been an extraordinarily short-sighted nation in some matters; and one of them has been in connection with German commercial strategy. The electrical industry offers pre-eminent illustration—not intentionally, but because the truth cannot be hidden. It has been generally known for a long time that the British electricity supply industry has been heavily concerned in contributing to the prosperity of Germany, and that it had received with the utmost cordiality the planting in this country of German manufacturing enterprise with German capital. It was said that this was preferable to things being manufactured in Germany. Consciences were salved by saying that buildings would be erected and equipped in this country with capital brought from Germany. The fact that most of the material and equipment would come from Germany mattered little; for would not the buildings and the businesses pay rates and taxes here, and employ labour, which labour would spend its earnings locally? See then how the country would profit. The gold shipped over to Germany representing profits on the capital employed was something about which little was said. But there is another aspect of this German enterprise which has not hitherto received the prominence it deserves; and the point is made by an "Electrical Correspondent" in the "Engineering Supplement" of "The Times." The lesson has of late been frequently impressed upon us that the most fruitful way of increasing the prosperity of the country is to enlarge our exports and reduce our imports. Germany was practising this at our expense long since. Several of these kind and beneficial German capitalized concerns were founded here for the dual purpose of getting as much as possible of the business that was going in the United Kingdom, and to protect the export trade of the parent companies, and thus of the Fatherland. In other words, these "British" companies with German capital showed their love for Great Britain by taking out of it all they could, while keeping as low as possible its export trade in electrical plant, and so by passiveness in regard to overseas trade, helping Germany to obtain and to retain it. "Electrical Correspondent" winds up his article by saying: "If there is to be a healthy patriotic spirit at work to put greater competitive power into the British electrical industry after the war, it is essential it should be clearly understood which firms stand wholly for British interest, and which are merely a kind of 'tied house.'" In other words, those firms which do not strive to increase British export trade, and in which there is German capital, should be left completely without home trade. In the national interests, such companies require freezing-out; and if they have no trade here, and do not try to get any abroad, well they will soon understand their room is preferable to their company. The British Electrical Manufacturers' Association have under consideration the question of mobilizing the energy and resources of genuine British firms for promoting their interests after their factories have seen the end of munitions work, and are again at liberty to promote ordinary business on the large scale.

A GAS-FURNACE DEMONSTRATION.

An excellent sequel to the paper read last Friday week by Mr. B. W. Brooks, on the "Application of Gas to Industrial Purposes," before the London and Southern District Junior Gas Association, was provided on Saturday afternoon, when some forty members of the Association visited, in Goswell Road, the industrial appliance show-rooms and demonstration workshops of the Gas Light and Coke Company, where they witnessed a number of tests carried out in different types of furnaces. First of all, however, there was an inspection of the well-equipped general stores, under the guidance of Mr. A. H. Webber, the Inspector-in-Charge. This concluded, the party assembled in the industrial appliance show-room, over which they were taken by Mr. Brooks (who is the Company's Special Representative) and his Assistant, Mr. Grover. An illustrated account of what has been done by the Company to provide facilities for demonstration purposes was given on p. 504 of the "Journal" for June 1 last; these facilities being an invaluable aid in bringing into the fold the increasing number of manufacturers who manifest willingness to consider the use of coal gas as a fuel in their factories and workshops.

Pointing out the features of the building, Mr. Brooks drew attention to the fact that the furnace-room was specially constructed, and occupies a floor-space of 1250 square feet. Both natural and artificial lighting are provided on a generous scale; the former by means of a glass roof, and the latter by an effective selection of high and low pressure lamps specially adapted to factory lighting. The power and compressing plant, which is installed in a communicating room, consists of a 6 B.H.P. gas-engine, driving a main shaft; a Worthington reciprocating pump-acting compressor, for supplying gas up to 15 lbs. pressure per square inch; a 1000 cubic feet Keith and Blackman rotary compressor, for supplying either gas or air at 4 lbs. pressure; and a No. 2 standard Keith high-pressure air-blower, capable of supplying 30,000 cubic feet of air per hour at 8 inches water-gauge pressure. The inlet and outlet pipes of the compressors and leads to the various furnaces are painted in different colours; and by referring to the gauge-board, it is easy to ascertain the pressure at which each appliance is working. Again, there are two 200-light dry meters fitted on the floor of the demonstration room, to enable customers to check the indices while tests are being made. The meters are fitted with bye-passes and pressure-gauges on the inlet and outlet connections; one meter supplying the natural draught and air-blast furnaces, and the other high-pressure gas.

The furnaces are of all sorts and sizes, by the leading makers; and there is also a varied selection of blow-pipes, soldering-irons, tinmen's stoves, high-power burners, &c. Inquiry elicited the fact that a good many of the appliances seen both in and out of action are attributable to the inventive faculty of Mr. Brooks, who in this way proves how thoroughly he has followed the plan which he recommended to his audience during the discussion on his paper—that is, to take each trade separately, and endeavour to master it, so as to find out just where gas would be useful, and, of course, how it could be best burned. Some of the appliances which were illustrated and described by Mr. Brooks in his paper were seen in being on Saturday afternoon.

After they had seen in action the internal heater, which has proved so useful for heating water, acids, &c., in cases where the outward application of gas would be either undesirable or impossible, some actual tests were taken with various appliances. The first were made in the low-pressure gas brazing forge, with air at 4 inches. Here a ¾-inch small steel chisel was heated in 2 minutes 32 seconds, with a consumption of 6 cubic feet of gas, starting hot, and a 1¼-inch tool in 4 minutes 19 seconds, with a consumption of 9 cubic feet of gas. Next a move was made to the sugar boiler (which, again, is worked with gas at normal pressure, and air at 4 inches); and in this what proved to be an excellent batch of toffee was made. For this, 28 lbs. of sugar and 5 pints of water boiled in 3 minutes from lighting-up; the whole process (requiring a temperature of 310° Fahr.) taking about 7 minutes, with a total consumption of 68 cubic feet of gas.

The next thing to interest the visitors was a demonstration with the oxy-coal gas welding plant, with which it is found possible to weld anything up to cast iron. Mr. Brooks stated that the Company find manufacturers prefer (for instance) to use oxygen and coal gas for repairing motor-car cylinders, because they get a more durable weld in this way than by employing acetylene. The work is preheated, and got up to a fairly high temperature; and in this way it is considered that a finer weld results. By the oxy-coal gas process, it is reckoned that a temperature of about 4000° Fahr. is attained. The caramel toaster—a useful little appliance—received its due meed of attention; and then an adjournment was made for tea, on the invitation of the Company. What they had seen had impressed upon the members two facts—the enterprise of the Gas Light and Coke Company, as exemplified by the admirable equipment of the demonstration room, and the ingenuity of Mr. Brooks, as displayed by the internal heater, the brazing forge, the sugar boiler, and the caramel toaster. Much interest was, of course, displayed in the large number of specialities by Messrs. Fletcher, Russell, and Co., the Richmond Gas Stove and Meter Company, and Messrs. John Wright and Co., which are on view in the room. Before the party rose from the tables,

The President (Mr. S. B. Chandler) said they had had to thank the Gas Light and Coke Company for very many favours extended to the Association in the past; and the afternoon they had just spent had been no exception to the rule which had always held—that the visit had been both enjoyable and instructive. The inspection had been specially interesting from the fact that, taken in conjuntion with Mr. Brooks's recent paper, it had given all of them both theoretical and practical experience of furnace work. The demonstrations they had just witnessed had proved that gas was able to perform what Mr. Brooks had told them it could do. Their cordial thanks were certainly due to the Directors of the Gas Light and Coke Company, Mr. F. W. Goodenough (the Controller of Gas Sales), Mr. Brooks, Mr. Webber, and Mr. Grover. He would ask the Senior Vice-President to propose a vote to this effect.

Mr. F. Pearce, in complying, remarked that, after hearing the paper Mr. Brooks had read to them, and seeing in use the different appliances for which he was so largely responsible, they could form a very good idea of the diversity of the uses to which gas could be put from an industrial point of view. In the previous session of the Association, the members paid a visit to another works, where a lot of work had been done in connection with gas-furnaces. He believed the system employed there was high-pressure gas; whereas Mr. Brooks's system was low-pressure gas and low pressure air, with which he was able to show a great saving.

Mr. D. J. Winslow, who seconded, referred to the great field which exists for this kind of work, and to the remarkably fine installation of furnaces they had seen. He was glad to note that so important an undertaking as the Gas Light and Coke Company had taken up this matter seriously. It was a serious matter. The average factory owner and foreman were very conservative as regarded the apparatus used. This, of course, was really quite natural. Manufacturers had had ample experience of heating with solid fuel; and they were not going to change unless it was clearly shown that they would derive substantial advantage from so doing. However, having taken up the question in the way they had, the next thing for the Company to do was to find a suitable man to look after things; and this he felt sure they had done in Mr. Brooks. It was very nice indeed to see so much apparatus that the man in charge was himself responsible for.

Mr. Brooks, in acknowledging the vote (which was cordially passed), said that, on behalf of the Company and of himself, he thanked them very much. They relied upon actual tests, and a careful study of the figures produced, to convince prospective customers as to the reliability and economy of the commodity they were trying to sell. This was one of the reasons for their success.

Mr. A. H. Webber remarked that it had been a great pleasure to have the members there, and to do what he could to make the visit a success.

The President subsequently announced that their late Hon. Secretary, Mr. A. R. Griggs, had obtained a commission in the Naval Air Service, and that Mr. D. Evans, also of the South Suburban Gas Company, had joined the London Rifle Brigade.

The members then returned to the demonstration room, where they spent a further hour in watching the biggest test of the day—the running-off of a melt of 80 lbs. of brass. The 80 lbs. of metal was put into a 150 lb. pot, and placed in a built-up furnace heated by Mr. Brooks's own burners, which are designed to consume gas and air at equal pressures without any governing device; the pressure during the test being in each case as nearly as possible 5 inches. The metal used was hard ingot brass, which had previously been melted about half-a-dozen times, so that, as was pointed out, it was practically as hard as copper. The unnecessarily large size of the pot, of course, was also against the test. However, starting from cold, the melting was done in 1 hour 5 minutes, with a consumption of 510 cubic feet of gas. This is equal to a consumption of about 6·3 feet per pound of metal, which, as Mr. Brooks said, might with this system be reckoned as the consumption necessary for copper. As a matter of fact, he stated that a few days previously 600 lbs. of brass had been melted, by the same system, in 2 hours 10 minutes, with a consumption of 2150 cubic feet of gas, which worked out at 3·58 cubic feet per pound of metal.

Thus was brought to a close a visit which had, without a dull moment, extended to over four hours.

Calculating the Diameters of Mains, &c.

A method of calculating sizes of high and low pressure mains services, &c., having for its object the simplification of the process, was described by Mr. George H. Elliott, Assoc.M.Inst.Mech.E., of No. 4, Rill Terrace, Exmouth, in a couple of articles which he contributed to the "Gas World" earlier in the present year. These the author has now had reprinted in the form of a handy little book, the price of which is 1s. 6d. net, and postage 3d. To the previous matter have been added a few notes to facilitate the estimation of gas consumption, most of the figures having been supplied by the manufacturers of apparatus. One chapter deals with the proportioning of services and interior fittings; and later on in the book the subject of illumination is treated simply and concisely. Here the student can obtain an explanation of such terms as the foot-candle, mean spherical candle power, the polar distribution curve, and some figures of illumination standards, reflective and obstructive powers, &c., arranged conveniently for reference. The consumptions of gas in fires, radiators, boilers, irons, cookers, and engines are not claimed to represent the absolute efficiency of gas appliances, but to be near enough to calculate the approximate consumption. Those who use the book will like to have it with them during working hours; so its small size is an advantage.

The Law and Parliamentary Committees of the Metropolitan Water Board estimate that the cost of securing their Act last session approximated to £3000; while the Board's opposition to Bills in the session 1913-14 amounted to £834.

A CRITICAL REVIEW OF THE METHOD EMPLOYED FOR DETERMINING HEATS OF COMBUSTION.

By Stanley Robson, M.Sc. (1851 Exhibition Scholar of the Armstrong College, Newcastle-on-Tyne), Research Student in the Department of Chemical Technology, the Imperial College of Science and Technology, London.

(*Continued from p.* 479.)

IV.—Work of Julius Thomsen. [1851-1886.]

The work of Julius Thomsen,* who perfected that of Favre and Silbermann, is no less remarkable for the discrimination shown in its selection than for its quantity. The choice of material for examination was determined by the following considerations:—

(1) It must be obtainable in a pure form.
(2) It must be a gas or be readily vaporized.
(3) It must belong to a group of theoretically important substances.
(4) It must be of sufficiently low molecular weight that a reasonably accurate heat of formation could be deduced from its heat of combustion.

This last consideration confined Thomsen's researches to substances with less than six carbon atoms in the majority of cases, though some aromatic compounds with nine carbon atoms were also studied. The reason for this limitation is obvious when it is borne in mind that the whole error of the determination of the heat of combustion falls upon the heat of formation which is deduced from it by difference, and is generally a very much smaller quantity.

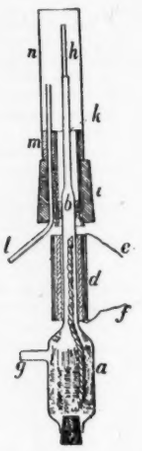


Fig. IV.—The "Universal" Burner.

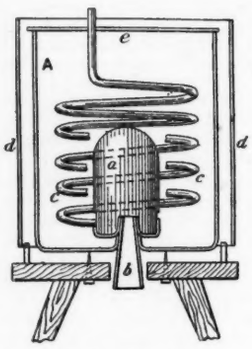


Fig. V.—Thomsen's Combustion Vessel.

Thomsen's apparatus differed essentially from Favre and Silbermann's in the discarding of elaborate jacketing arrangements for the calorimeter, and in the mode of regulating the combustion. With gases, regular combustion could only be achieved by providing against variations in pressure of the gas and the oxygen supplies, and the still more disturbing influence of oscillations in pressure, due to the bubbling of the gas and the products of combustion through liquids in the various accessory absorption apparatus. Constant gas pressure was readily obtained by means of properly devised aspirators. To provide against the irregularities due to bubbling, sections of capillary tubing were inserted in the apparatus. One was immediately in front of the entrance to the calorimeter, which prevented any back-flow of the gas; another in front of the absorption apparatus; and a third immediately in front of the potash bulb. To counteract the resistance of the absorption apparatus and the constricted areas, an aspirator [G, Fig. VI.] was introduced at the end of the apparatus. Any desired constant pull from this was obtained by arranging the level of the vessel *d*; the difference between its outlet and the lower end of the tube *a* being a measure of its suction.

The total effect of these devices was to give such a constant flow of gas through the apparatus that the water manometer *n* showed no variation in pressure. Complete control of the flame was by this means obtained, and the combustion could be maintained as nearly as possible perfect.

Thomsen made special provision for the complete combustion of volatile organic compounds. His method was to supply the vapour of these substances to the combustion vessel at a constant rate and at a constant known temperature. To effect this, an apparatus which he named the "Universal Burner" was used. This is represented in Fig. IV. The liquid to be burned was placed in a small bulb *a*, and passed up by means of a wick of purified cotton or asbestos into the tube *b*, where it was heated by means of a spiral of fine platinum wire *e*, *f* to any desired temperature. By maintaining a regular electric current through *e*, *f*, a constant evolution of vapour could be maintained, and accordingly the size of the flame at *h* did not vary. In order to prevent any condensation of the vapour in its passage from *b* to *h*, a double silver wire was introduced into the tube *h*, which, being made of platinum foil, became strongly heated, and communicated its heat to a silver wire throughout its whole length from *h* to *b*. Thomsen considered that this prevented the vapour from being cooled, and at the same time did not produce any modification in the quantity of heat that was supplied to the calorimeter.

Many substances when burned in an atmosphere of oxygen, under ordinary conditions, give rise to a smoky flame, and thus tend to block-up with carbon the orifice of the burner. Complete combustion, however, can be effected by volatilizing the substance at a suitable temperature by means of a gas. For this purpose, either ordinary air or varying quantities of oxygen and nitrogen, or hydrogen, were introduced through the opening *g* of the lower bulb. The rate of flow of the gas, and the intensity of the electric current, were then regulated until the flame was of the requisite size, and burned without smoke or the deposition of carbon. The burner was attached to the combustion vessel Fig. V. by means of the stopper *i*. The oxygen required for the combustion was admitted through the tube *l*. Next to the indiarubber stopper was a cork disc *m* of somewhat smaller diameter. This supported a platinum tube *n*, surrounding the two tubes, through which entered the oxygen and the vapour to be burned. Its object was to render the oxidation more effective; and for this purpose it was filled with glass-wool up to the lower part of *h*. The current of oxygen was regulated in such a manner that the gases leaving the combustion vessel were mixed with about 50 per cent. of free oxygen.

The calorimeter Fig. V. was not surrounded with a series of external jackets, since it was possible to arrange that the temperature of the laboratory where the experiments were carried out did not vary more than one-tenth of a degree during the course of several hours. It was, therefore, simply protected from any possible radiation from the person of the experimenter, by means of an ebonite cylinder *d* open at each end. This screen was supported at three points, and in no way interfered with the free

* "Thermochemische Untersuchungen."

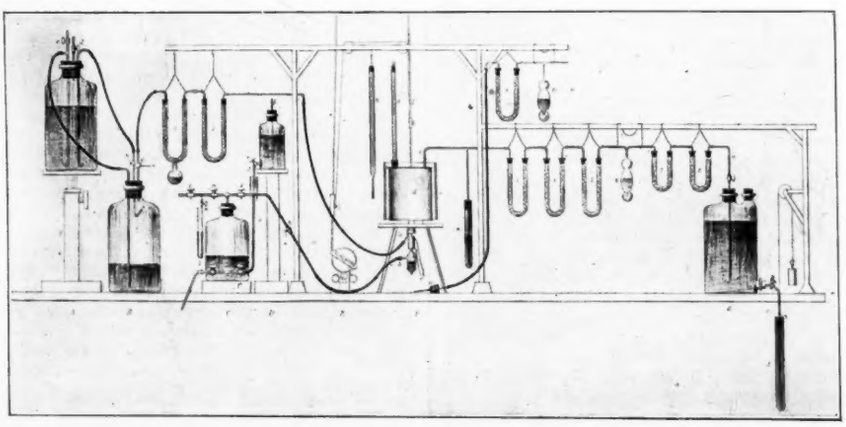


FIG. VI.—THOMSEN'S APPARATUS FOR MEASURING HEATS OF COMBUSTION.

circulation of the air around the calorimeter. The cover *e* was also of ebonite.

Fig. VI. shows the apparatus completely assembled. The oxygen was supplied from the constant head gasholder A, B, and that passed through the drying tubes 1 filled with sulphuric acid and 2 with caustic potash. As the tube through which the oxygen passed to the burner was constricted close to F *a*, in order to diminish the variations in atmospheric pressure, the oxygen in B had always an excess pressure which was kept between 10 and 20 cm. water gauge according to the adjustment of the height of A. The gas under examination was stored over mercury in C D. If it contained more than one atom of carbon in the molecule, it was diluted with dry atmospheric air freed from carbon dioxide, or else with air mixed with oxygen, in order that the combustion might take place without the deposition of carbon. The velocity of the gas fed from this holder was determined by the quantity of mercury flowing out of D per minute; but the tap *h* was always turned so that there was an excess pressure of 2 to 3 cm. of mercury in C—this pressure being registered on the manometer K.

F represents the calorimeter and its accessories already separately described. A thermometer *g* was fitted through the lid, and a similar thermometer suspended by the side of the calorimeter to register the temperature of the air. When the combustible substance contained only carbon, hydrogen, and nitrogen, the tube 3 held a mixture of sulphuric and chromic acids; tube 4 calcium chloride; tube 5, concentrated sulphuric acid—these tubes retaining water vapour and oxides of nitrogen. Tube 6 was a Liebig's bulb containing a 40 per cent. solution of caustic alkali; and tubes 7 and 8 were tubes containing solid caustic potash.

The following was the method of procedure: As soon as the amount of water in the calorimeter was weighed, the calorimeter prepared, the stirrer and the thermometer put in their places, and communication with the absorption apparatus established, the mechanical stirrer was started to allow a uniform temperature to be established in the calorimeter. When working with a non-gaseous body, the electric current was first started in order to heat-up the burner. One or two minutes afterwards, the current of air was led into the volatilizer, where a flame of the size previously arranged for was produced.

One minute after these preparations were completed, the calorimetric measurement was commenced; the time being noted by means of a stop-watch. The temperature of the air and also of the calorimeter was noted, and readings were taken at the end of the second and third minutes. At the end of the fourth minute, the combustion in the calorimeter was commenced, the universal burner being placed in the opening of the calorimeter which it closed tightly. The tube *d* of the aspirator was then raised or lowered till the manometer *m* registered a depression of 1 cm. of water, which was the desired pressure in the calorimeter.

All was then in order, and remained unchanged throughout the course of the combustion. This applied to the rate of flow of the oxygen and of the gas in the holder C, as well as to the vaporization brought about by the electric current in the burner, and to the regular working of the aspirator.

The conditions under which the combustion was proceeding were ascertained by watching the manometer, since any irregularity would be at once shown by a considerable alteration in the level of the water. An increase in temperature of the calorimeter was always found to be proportional to the time, which indicated the maintenance of constant conditions during combustion.

When the temperature of the calorimeter had risen to the required degree, the combustion was interrupted by shutting the tap *d* of the gasholder C. The burner was then removed from the calorimeter, and replaced by an indiarubber stopper, through which a glass tube was inserted. This tube was connected-up with the absorption tubes 9, which contained solid caustic potash, and 10, which contained a 40 per cent. caustic potash solution. The aspirator, working continuously, drew through the calorimeter a current of dry air free from carbon dioxide. The rate of flow was regulated by means of the tap *d* so that about 160 cc. of gas passed per minute. The apparatus was then left untouched for fifteen minutes, during which time the temperature was read every three minutes. At the end of this time, the experiment was finished; and the absorption tubes 6, 7, and 8 were detached and subsequently reweighed.

Thomsen's Method of Correcting his Observed Temperatures.

Thomsen employed a very involved method of correcting for losses or gains of heat in his calorimeter. This was necessitated by the comparatively long duration of his experiments. However, the corrections are so intricate that it is impossible to discuss them here. A full description is to be found in the "Thermochemische Untersuchungen, Vol. IV., pp. 22-46."

The general equation on next page represents the method used

HEATS OF COMBUSTION—In Cals. per Gram Mol. or Gram Atom.

Substance.	Method of Preparation and Purification.	Experimental Values.	
		Rhombic Sulphur.	Monoclinic Sulphur.
Sulphur	Not given	70,950 71,220 71,080 71,080	71,636 71,810 71,720
Carbon monoxide	Not given		68,093 67,971
		67,513 67,914 68,321 68,073 67,957	68,198 67,961 67,593 67,927 67,955
		67,960	
Hydrogen	Not given.	68,388 68,467 68,231 68,357	
Methane	Prepared from sodium acetate and lime Purified by passage through sulphuric acid, nitric acid, and copper chloride	212,370 212,846 211,000 213,110 212,190 211,400 211,090 212,370 211,030 211,930	
Ethane	Prepared from zinc-ethyl and hydrochloric acid, gave on analysis $C_2H_{6\cdot030}$ and $C_2H_{6\cdot080}$. Prepared also by electrolysis of sodium acetate, gave on analysis $C_2H_{6\cdot033}$	370,640 369,720 372,330 370,900 370,400	368,180 370,180 372,550 369,480 370,100
Ethylene	Prepared from alcohol and sulphuric acid, gave on analysis $C_2H_{4\cdot240}$ Thomsen believed this gas to contain methane in the proportion $C_2H_4 : CH_4 = 1 : 0{\cdot}1277$	334,020 333,750 332,400 333,390	Corrected to 333,350

Substance.	Method of Preparation and Purification.	Experimental Values.	
Acetylene	Prepared from soda lime and ethylene bromide, gave on analysis $C_2H_{2\cdot013}$	310,300 307,150 310,510 310,130 309,520 310,050	310,570
Benzene	Prepared in several ways by commercial firms of repute	799,980 799,930 798,490 802,180 795,480 799,218 801,160	Kahlbaum's 800,540 Schuchard's 799,860
Ethyl alcohol	Not given	341,260 341,180 341,110 342,040 342,020 341,370 341,670 342,400 342,130 342,090 341,790	
Carbon disulphide	Not given	263,670 265,790 264,750 266,940 265,290	
Cyanogen	Prepared by gently warming mercuric chloride and mercury cyanide	259,400 260,300 259,610 259,180 259,620	
Hydrocyanic acid	Not given	158,030 158,860 158,690 158,900 158,620	

Note.—The above values for benzene, ethyl alcohol, and carbon disulphide are heats of combustion of the vapours at their boiling points.

to determine the molecular heat of combustion of a substance from the experimental data.

$$R_1 = (t_2 - t_1 + \phi)\, A\, \frac{44\,a}{a} + (\omega + \gamma) - \psi$$

R_1 = The molecular heat of combustion.

t_1 = The corrected initial temperature of the calorimeter. To obtain this the temperature was read at 4, 3, 2, and 1 minute intervals before the combustion, and was then calculated from $t_0 = t_1 + \frac{1}{4}(t_3 - t_4)$ which was derived by the method of least squares.

t_2 = The corrected final temperature of the calorimeter. To obtain this the temperature was read at minute intervals for fifteen minutes after the end of the combustion—the values at six, nine, twelve, and fifteen minutes being used and the actual temperatures given by the equation $t_0 = 1{\cdot}3t_6 + 0{\cdot}6t_9 - 0{\cdot}1t_{12} - 0{\cdot}8t_{15}$ according to the method of the least squares.

ϕ = The correction for the alteration of the zero of the thermometer.

A = Water equivalent of the apparatus.

$\frac{44a}{a}$ = Factor for the reduction of the terms to gram molecules.

44 = Mol. wt. CO_2.

a = Number of carbon atoms in molecule.

a = The weight of CO_2 formed.

$(\omega + \gamma)$ = The heat lost by the evaporation of sufficient of the water formed in the calorimeter to saturate the products.

ψ = The heat lost to the exit gases and is calculated from the difference in the temperature of the exit and entering gases and their specific heats.

Little comment, other than appreciation, can be made upon Thomsen's work. For patience and skill, it has been in all probability only rarely equalled. It is unfortunate, however, that he should have been so absorbed in the construction of a science of thermochemistry; for in work of this character it is under such circumstances almost impossible to avoid bias towards experimental methods which favour the deductions made early in the course of the investigation. How far Thomsen was so biassed (if at all) is obviously unknown; but he has certainly been charged with this error.*

The most obvious point for criticism in his apparatus is the "Universal" burner. The presence of an external source of heat is objectionable no matter how careful its regulation may be.

A further objection which has been laid against Thomsen's work is his method of temperature correction. This, as Berthelot† pointed out, depends only on the theory that the temperature losses and gains vary with the excess in temperature of the calorimeter over that of the neighbouring air; any correction for the loss of heat from the calorimeter by evaporation being neglected. However, the errors due to thermometric readings are probably smaller than in bomb calorimetric methods, owing to the greater increase in temperature during an experiment.

As in the case of other investigators, the methods employed by Thomsen for the preparation of some of his gases leave room for doubt as to their purity. This is especially the case with his method of preparing methane and ethylene. He prepared methane by heating a mixture of sodium acetate and lime—a method which cannot be considered as satisfactory. Ethylene was prepared by heating a mixture of ethyl alcohol and sulphuric acid. These gases would certainly be contaminated with impurities which could not be computed by means of any method of analysis; and as Thomsen's values for the heats of combustion of methane and ethylene are nowadays accepted without question, it is necessary to call attention to them.

(To be continued.)

* Lemoult. Ann. Chim. et Phys. † Compt. Rend., XC., p. 1241.

Separating Water Gas into its Constituents.

The specification of a patent taken out in Germany in 1913 by the Badische Anilin und Soda-Fabrik is abstracted in the "Journal of the Society of Chemical Industry." It is pointed out that if water gas or similar gaseous mixture be compressed and then allowed to expand, the lowering of temperature produced is not sufficient to liquefy the constituents other than the hydrogen present in the gas. The invention referred to consists in adding carbon monoxide or nitrogen, which show a positive Thomson-Joule effect, to the gas, before compression, in such proportion that the lowering of temperature produced on expansion is sufficient to liquefy the major portion or all of the constituents other than hydrogen. The enrichment of the gas in carbon monoxide or nitrogen may be effected by modifying the method of preparation, or by adding a suitable gas to the gaseous mixture containing hydrogen. When the process is once in operation it is only necessary to add a certain quantity of the constituents (carbon monoxide, nitrogen) which are liquefied, to the gas under treatment, in order to obtain the desired result; or the liquefied constituents may be fractionated and the most volatile portion, still containing some hydrogen, added to the gas under treatment.

COKE AND OTHER MATTERS.

By "Qui Vive."

Now that it is so difficult to transport coke from one district to another, it is more than ever necessary to dispose of the whole of the production in the neighbourhood. This may seem, and undoubtedly is, a tall order in some districts; but, even so, it is frequently the fault of the management, who have persistently given the matter insufficient attention.

With railway waggons so much in demand for the transport of war material, there will be very little temptation to dispose of a surplus coke stock in other districts—which is all to the good, at any rate, from the point of view of developing local trade. To induce a manufacturer or other large fuel user to transfer his custom from coal to coke may rightly be looked upon as a triumph; and such development work should be strongly encouraged by the local authorities in the interests of smoke abatement. Unfortunately, however, it is too often the case that these same authorities are themselves, collectively or individually, offenders in the matter of smoke production, and shrink from taking any steps in a matter which will show up their own delinquencies.

Parliamentary War Savings Pamphlet.

To push coke at the present time no better means could be suggested than that of distributing the leaflet prepared by the Parliamentary War Savings Committee, which strongly advocates the use of coke instead of coal. It is true that this is addressed to householders; but anyone perusing it, whether he be a householder or manufacturer, would realize that it was equally applicable to either, and, further, the fact that it is authoritative advice makes it the best possible advertisement. Seeing that it urges the use not only of coke but also of gas, there is every reason for making capital out of this official pamphlet, as by doing so one is not only helping oneself but the Government as well. Its distribution to all manufacturers and other large fuel users, accompanied by a letter setting out the terms upon which gas and coke are supplied in large and small quantities, would undoubtedly cause a good deal of inquiry, and should lead to a fair amount of business. In this connection it should not be forgotten by readers that large supplies of the leaflet referred to may be procured, free of charge, upon application to the Parliamentary War Savings Committee, No. 12, Downing Street, S.W.

Formation of Coke Committees.

Much good work could be done in the direction of pushing coke for steam-raising purposes if the undertakings in the large Provincial districts could be induced to follow the lead set them by the Metropolitan and Suburban gas companies, who, early in the day, formed the London Coke Committee, with a view to taking steps to keep the question of coke well to the fore. Not the least of its achievements has been the appointment of an expert (Mr. E. W. L. Nicol), whose business it is to approach large fuel users in the districts of those undertakings that compose the Committee, and to urge them to give a trial to coke for various purposes—notably for boilers and steam-waggons. Excellent work has been done, and large numbers of important converts have been made.

It is not, however, satisfactory that London should be the only district in which this important work is being carried out. Why should there not be a Lancashire, a Yorkshire, or a Midland Coke Committee, or a Coke Committee attached to each Gas Association? Many members of these Associations would undoubtedly welcome such a step. It may, of course, be said that the present Commercial Sections render unnecessary the formation of any such Committee; but if so, there is one very important omission, and that is the mission of the "expert," who should be the life and soul of the organization. The ideal Committee should concern itself chiefly, and almost entirely, with the advertisement of coke, its practical trial in works in competition with coal, suitable appliances for its use, and such practical questions as to the correct size for different purposes. The expert and his report should always be the main business at each meeting.

Is it not possible to carry out this suggestion? Whether it is in connection with existing Commercial Sections or newly-formed Coke Committees is not a material point, so long as the expert for each district is duly appointed. With some short-sighted undertakings the question of expense will be an insuperable barrier, though it is probable that a small annual sum invested in this way would reap a rich harvest. But niggardliness has too often been shown to be a factor of importance for it to be overlooked.

The suggestion is therefore made that this difficulty, should it exist, could be overcome by the appointment of an engineer for part time employment only. It is essential that he should be experienced in the working of boilers, and if he should already be engaged in the manufacture and sale of any boiler accessories or fittings, and be therefore acquainted with boiler users, it would be an advantage rather than a detriment.

Better far to have a competent and whole-time engineer, who should find more than enough useful work to keep him fully occupied; but the other suggestion is mentioned in view of sceptical and penny-wise people who will rarely give any scheme more than a half-chance of succeeding.

HIGH POWER OR LARGE GAS-ENGINES.*

This is a book on large gas-engines written by H. Dubbel, but translated from the German by F. Weinreb (a Manchester consulting engineer), who has edited and expanded the volume, "so as to include British engines and British practice." The purpose of the work was to act as a guide to the theory, principles of operation, design, and generally the more important constructional features of large four and two cycle gas-engines. Translation has been undertaken by Mr. Weinreb mainly because—and this suggests the chief value of the volume—of the large number of sectional drawings contained in the book; and to these have been usefully added others illustrative of British design. The advent of the large gas-engine is attributed to Continental enterprise, and its success regarded as the result of a comparatively freer exchange of ideas and designs abroad than at home.

Although full credit may thus be given, it should not be forgotten that it was Mr. B. H. Thwaite who in this country first used blast-furnace gas for internal combustion engines. This gave scope for the large engine which Germany was quick enough to develop and construct, but it is believed was put into practical and successful use at the John Cockerill Works at Seraing, near Liége, Belgium.

Speaking broadly, British engineers, although once deterred by uncertainty as to the future of the large engine, were probably more influenced by the question of its first cost, and, too, by the general possibilities and adaptability of the steam turbine. Judging, however, by the adoption of large engines in this country and America, there is now an absence of any feeling as to the unreliability originally due to constructional weakness of important parts, and to difficulties with valves and valve-gears. English practice has brought about departures from the earlier designs, with good results in simplification and efficiency; and there are several firms in this country who are making engines of very high powers. There is probably a great future for this class of engine, particularly in districts where blast-furnace or coke-oven gas is available; and it has been said that those of British design are likely to occupy a very prominent position in the field.

Neither the author nor the translator in his additional matter has, however, expressed any opinion as to the scope and possibilities of the purely large engine, and little as to its merits or demerits. No information is given as to the initial cost of plant and foundations, or the expense of working either with or without reference to competitive forms of power. The money aspect, after all, has a very important influence on the development of any apparatus; for prospective economy tends to stimulate ingenuity and improvement. There are obviously many facts to be considered—the capital necessary for large gas-engines and steam plants respectively, bearing in mind that attempts to cut the price of the former may seriously reduce its superior fuel economy; charges for interest, depreciation, repairs, and attendance; and the availability and cost of fuel. There are figures on record, and therefore could be quoted, which would have been useful in this book. It would seem that there is little to choose between modern steam engines and turbines on the score of fuel, but very material gain where large gas-engines are used. But one would like some idea of other important costs, such as that of plant.

Apart from these considerations, the author, or authors, have presented a book which, while including theoretical calculations, is also serviceable from a practical point of view, especially as it illustrates so well the design and chief constructional features of the principal large engines. The German makes naturally, from the origin of the book, come in for chief notice. Unfortunately, the treatment of phases of the subject is to some extent disjointed, and at times not very lucid.

In the first two chapters, the author discusses, theoretically and shortly, the gas-engine cycle, the fuels—furnace gas, coke-oven gas, and producer gas—used for driving large engines, and cylinder dimensions in relation to output.

After another short chapter (six pages) on hit-and-miss governing, quality or mixture governing, quantity or charge governing, and combined governing, we come to a more lengthy discussion of four-cycle and two-cycle engines. Yet discussion is scarcely the word. There has been from time to time some controversy as to the comparative merits of these types; and it would have been of service if the author had supplemented, with some expression of opinion, the comparison made on p. 81. He states that, so far as theoretical thermal efficiency is concerned, there is nothing to choose between the two and four cycle methods of working, but that in practice the gas consumption per B.H.P. is highest in the first case, the negative work of which being twice that of the four-cycle engine. The two-cycle engine is also at a disadvantage on the score of speed, which has a limit of about 100 revolutions a minute. On the other hand, the speed can be more easily varied. This facility, together with the smaller space required, favours the two-cycle engine for blowing and pumping purposes. There are other advantages not mentioned—such as reliability, quicker starting power, &c.

Notwithstanding these points, some engineers consider the four-stroke cycle the proper one for gas-engines, as the two-stroke engine must be accompanied by air and gas compressors. Its greater speed, accuracy of governing, and higher range as to size, are factors in its favour.

The chapter on four-cycle engine valve-gear is interesting, in view of the variety of devices adopted to meet the several conditions of mixture, charge governing, and their combination, and also of the many excellent illustrations included.

In dealing with two-cycle engines, reference is made to the considerable modification of the Körting engine by English makers—work which has taken place with advantage as to simplicity, compactness, and efficiency. To quote the author: "The cam-shaft has been abandoned, the crank-shaft drives the governor directly, and also the inlet valves by an eccentric rod and rolling levers, the back inlet valve being connected by a rod to the front inlet valve." This is an improvement on the original design.

The question of ignition occupies Chapter VII., and low and high tension with their timing devices are described and illustrated. The effect of using several ignition plugs, instead of one plug, is shown by diagram.

The difficulties experienced in making large cylinders to stand expansion strains naturally invests with interest the chapter on cylinders. These pages are probably as good as any in the book, since the author (for once) supplements mere description with some, although not very full, discussion of the points raised. He deals with the methods adopted by different makers to reduce as much as possible casting stresses, and such stresses as are due to differences of temperatures during the running of the engine. The causes and avoidance of cracks by such means as the thickening of the outer jacket compared with that of the inner cylinder, equal distribution of metal, and symmetry of cylinder are treated; but in part the influence of similar factors is only to be appreciated by the student from careful consideration of the various designs included in the chapter. It is, however, now recognized that troubles from cracking and the like have, to all practical purposes, been overcome.

So far as valves are concerned (Chapter IX.), it is pointed out that no special cooling arrangement is required for the inlet valve, since this is effected by the incoming gases, but that the exhaust valve, exposed as it is to the high temperature of the exhaust, is in most cases water-cooled—an English firm being the first to do this. It is remarked, however, that uncooled exhaust has been recently used without any trouble by one German firm. No great stress is laid upon the difficulties experienced with the exhaust valve, although it has been shown that special attention has to be paid to its adequate cooling, accessibility, and facility of renewal.

In connection with the subject of pistons referred to in the next section, the author considers it is best, but he is not very emphatic in the advice, to use stay bolts for strengthening purposes. Although the wisdom of using ribs is questioned by some, he says that many firms do not regard rib-stiffened pistons as bad practice, provided that care is taken to cool the casting. Where failure has taken place, the student is left to infer that it was attributable to a wrong arrangement of ribs. Differences in types of pistons, and methods of fixing and cooling, are shown by illustrations of various makes.

The general design of the principal parts (frames, bearings, crossheads, rods, shafts, &c.) of large engines is dealt with in Chapter XII. in much the same way—that is to say, drawings of manufacturers are reproduced and allowed, with brief accompanying remarks of the author, to tell more or less their own tale. Unfortunately, the method is not instructive, and one has to look elsewhere for information on some points.

Chapter XV. deals in general terms with the piping required for supplies of gas, air, and water, and also for the exhaust. The principal pipes of two blast-furnace gas blowing engines (900 mm. stroke 94 revolutions per minute) are shown; but while the mean air and gas velocities, in cubic feet per second, are stated, the reader looks in vain for any information as to the diameters of the pipes suitable for the work. Methods of reducing the noise and vibration caused by exhaust are indicated.

Some idea regarding the quantity of water required for large gas-engines is obtained by the statement that the consumption is about 4½ to 6 gallons per B.H.P. per hour, allowing for a rise of temperature from 15° to 45° C. This quantity is much more than that required for ordinary gas-engines, and the question of water supply merits attention, particularly as with some engines the water may run up to much greater figures than those given. Any higher temperatures than 45° C. are to be avoided; otherwise scale may involve trouble.

The last chapter includes a very interesting set of diagrams, illustrative of defects caused by ignition and pre-ignition under different circumstances.

The numerous plates and drawings which are appended are well worthy of study. A perusal of the book gives a good idea of the many difficulties met with in the construction and use of large engines, and at the same time of the engineering skill which has been so successfully applied to their removal. The volume is capable of useful textual expansion in view of the value of its illustrations.

* "High-Power Gas-Engines," by H. Dubbel. London: Constable and Co. Price, 18s. net.

The Work of the Institution of Gas Engineers.—In the "Journal" for July 20 last, there appeared an extended notice of Part I. of "Gas Engineering and Gas Manufacture: A Review of the Institution of Gas Engineers." This covered the period from 1863 to 1883. We have now received from Messrs. J. G. Hammond and Co., a copy of Part II., dealing with the years 1884 to 1894. The review is edited by Mr. C.W. Hastings.

CARE AND MAINTENANCE OF THE "DE BROUWER" RETORT CHARGING AND DISCHARGING PLANT.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Continued from p.* 482.]

De Brouwer Discharging Machine.

The "D. B." pusher or discharging machine, of which a photograph is shown in fig. 5, has, structurally, much in common with the charging machine or projector. But whereas in the latter machine there is no back thrust, in the ram machine the frame of the apparatus has to withstand the entire strain caused by the pushing action of the ram on the caked coke in the retorts.

The portion of the machine containing the actual discharging mechanism is, as in the projector machine, suspended within an outer frame in which it can be raised or lowered to accommodate itself to the particular tier of retorts which have to be pushed out. As in the case of the projector, the outer frame is mounted on four travelling wheels, and is propelled along in front of the retorts by an electric motor mounted on the sill plates and controlled by a tramway type controller fixed on the operator's platform. This motor performs the dual duty of propelling the entire machine and of raising or lowering the inner, or discharging, element; the change from one motion to the other being performed by means of a clutch lever situated at the side of the travelling controller.

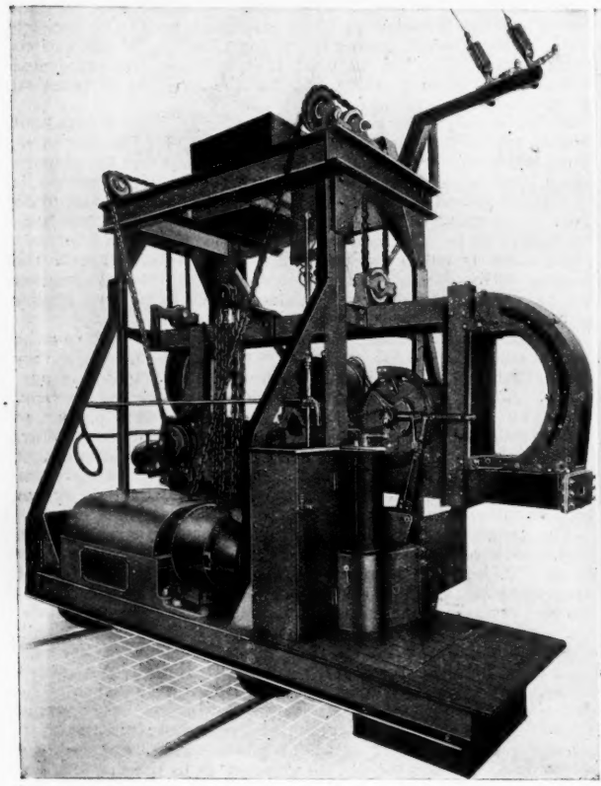


Fig. 5.—The "D.B." Discharging Machine.

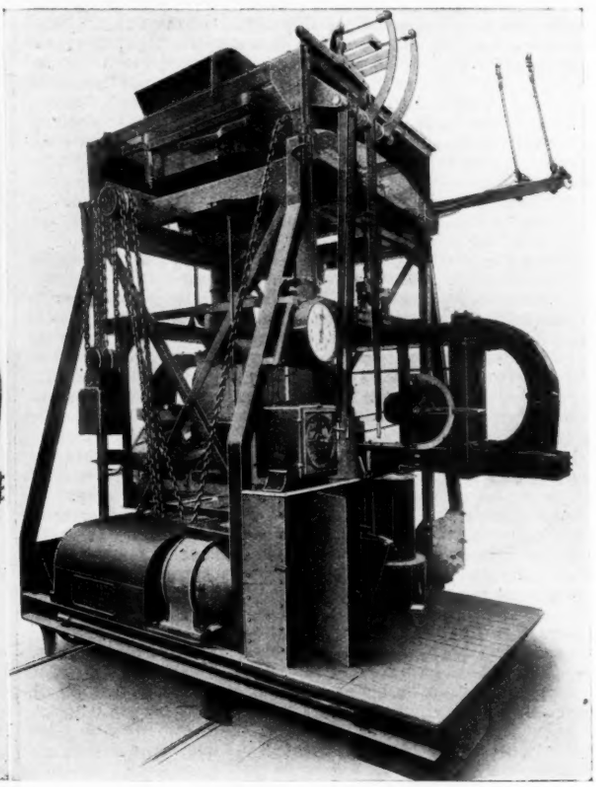


Fig. 6.—The "D.B." Complete Stoker.

The frame, while built on the same lines as that of the lighter projector machine, is much heavier, in order that it may withstand the back thrust alluded to previously; while the motor used for propelling and raising is of 11 B.H.P., running at 350 revolutions per minute.

The ram or pusher element of the machine consists of two or three telescopic lengths, the outer length of which is fitted with a pusher-head. Rack teeth are cut on the underside of these lengths. In order to allow of its being driven through the machine and retort, a number of links, each with similar teeth cast on, are attached to the tail end of the telescopic lengths; thus forming a long rack, which, by the construction of its component parts, is flexible in one direction only. That is to say, on the return stroke of the machine the links will take the semi-circular path offered them by the curved guide-plate at the back of the machine, but on the other stroke the entire element will extend as a solid bar inside the box-shaped guiding lengths.

When erecting, the most convenient way of putting the ram and chain together is as follows: The second and third lengths of the telescopes are placed in position in the hanging frame, the plain links are attached to the rack and put into the second length from the front, while the rest of the chain, ready coupled together, is put in, upside down, on the top return path. The lug link is then brought round to the back guide casting, opposite one of the openings in it, and the rack and plain links pulled in together until the two parts of the chain come together and enable the remaining pin to be put in and riveted up.

The front catch requires very careful adjustment. The cam must be so set as to lower the catch slightly before the respective lengths move forward, and both stops on the cam should be checked to see that they are clear and remain clear until the telescopes have returned to their respective positions. To ensure the catch being properly set, the gear wheels and the differential gear at the front end of the hanging frame are marked, and the wheels should be so set that the teeth so marked are in mesh with one another when the telescope is right back in its position of rest and the catch is in its top position holding back both lengths of telescopes.

It is important that the contact edge of the front catch should be kept square, also the bottom front edges of the channels, as these are liable to become worn, with the result that the catch would not hold the telescopes and they would go forward in the wrong order. To keep the telescopes as cool as possible, the machine is fitted with water-spraying apparatus. A spray pipe fixed over the pusher-head is connected to a small overhead tank, and holes for the reception of the water are provided in the top plates of the telescopes. The flow of water is regulated by a cock which is fitted with a long rod and a handle arranged in a convenient position near the operator.

To obviate the possibility of the ram being over-run on either its outward or return stroke, a safety device is attached to the tramway type controller by means of which the ram motor is regulated. The function of this gear is to automatically stop the motor at the ends of both strokes. It consists of a differential gear driven from the ram motor countershaft by means of a 1-inch pitch Hans Renold chain. In order to start the ram in motion, a hand lever is arranged on the side of this differential gear box and made adjustable to suit the height at which the ram is working by means of three notches, into which it fits with a spring lock, so that when working on the bottom tier of retorts the lever is held in the top notch.

To start the ram on its outward stroke the lever is moved

slowly downwards in steps equal to the five notches on the controller, and when the ram is about 3 feet from the end of its maximum stroke, one of the tappets on the safety gear engages with the lever and commences to bring the controller to its off position, which position is reached simultaneously (if the tappets are correctly set) with the end of the stroke. The lever is now free to be moved upwards in steps (as before) for the return stroke; and in the same way the second tappet on the differential gear comes into operation when the ram is about 3 feet from its "home" position and commences to bring the controller to its "off" position. The gear is so proportioned that the outer element makes about three-quarters of a revolution during the complete stroke of the ram, and is so arranged that, having once come into action, the operator cannot move his controller back to the last position, but can only reverse.

The ram is operated by a motor of the same type and size as that used for travelling purposes; the drive being transmitted from the motor countershaft to the gearing at the front of the ram by means of a 2½-inch pitch roller chain.

Electrical Arrangements.

The current collecting arrangements are the same as in the projector machine; the current being brought to the distributing point *viâ* a main double pole switch and an automatic circuit breaker. The current for the ram motor is transmitted to the hanging frame *viâ* two banjo wires strained vertically on the outer frame, and collected by means of two spring collectors. The two main leads from the distributing point are connected to these banjo wires. It will be noticed that whereas in the projector machine three banjo wires are required, only two are used on the ram machine, owing to the motor in the hanging frame being a compound-wound machine and having no variable shunt rheostat.

In the case of the ram machine, both the travelling-hoisting and the ram motors are interchangeable in all respects. This practice may, in the case of the heavy complete stoker [of which a description is given in a later portion of this article] lead to the ram motor being somewhat too large for its work. But it must be remembered that these machines usually come in for some very rough handling; and it is an advantage to have the motors of ample size for their work, as motors liberally rated in this respect are far less liable to give trouble from burn-outs and minor faults. The motors are permanently compounded machines—sufficient shunt turns being added to a series type motor to give a fairly regular speed, even under light loads—and are both operated by controllers of the tramway type.

The electrical connections of both the motors are as shown in fig. 4 [*ante*, p. 481]. But, in the case of the ram motor, provision is made, as has already been described, for bringing the controller to its "off" position automatically with the arrival of the ram at the limits of its stroke; the entire equipment, motor, controller, and resistances, being carried on the hanging frame, on which the ram itself is mounted.

Another automatic electrical device fitted to this machine is for the purpose of preventing overwinding when raising or lowering the inner frame. It consists of an automatic cut-out switch fixed at the back of the controller. The tappet levers operating this switch are adjustable, and care should be taken when setting the gear to ensure that the switch operates when the top and bottom positions of the hanging frame are reached. When this switch operates, needless to say, the controller should be brought to its "off" position before closing the tappet switch.

The Complete Stoker.

The complete "D.B." charging-discharging machine is simply a combination of the projector and ram machines—both the projector and the ram, with their respective operating machinery, being fixed on one hanging frame, on which they are levelled-up in such a manner as to allow of a retort being first discharged and then filled without any alteration in the vertical adjustment of the inner frame. The general construction of the inner and the outer frame is, of course, heavier than in the case of the single machines. The area covered by the complete stoker is, however, considerably less than that taken up by two separate machines; while experience has shown that this combination of two excellent machines has not in any way interfered with the high reputation which the "D.B." machines have always enjoyed in respect to low maintenance charges.

It has been argued that, in the event of an accident occurring to the motor or other part of the mechanism, the entire stoking plant would, in the case of the combined machine, be brought to a standstill. This argument will certainly be applicable to a very small extent in the case of a single installation; but it must be remembered that the liability of a machine of this (or, indeed, of any) type to a breakdown is largely proportional to its load factor—namely, the proportion of its working hours in any given period to the total number of hours in that period. It sometimes happens that a machine has, single-handed, to deal with such a number of benches as to necessitate its almost continual operation. This practice leaves a very small margin for the attention that is absolutely necessary for the well-being of the plant, and leaves none at all for the ever-present possibility of breakdown, and can only be characterized as a "penny wise and pound foolish" policy, unfair to the machine, to its makers, and to the shareholders of the undertaking pursuing it. An undertaking which can afford to adopt a machine of this type, and which is of a sufficient size to keep it continually at work, should be certainly able to put down a second machine and to use the two alternately. The extra expense would soon be saved by the reduced repair bill and the freedom from those breakdowns which must occur on any machine which has to undertake such heavy duty continuously.

Returning to the case of an undertaking whose load factor in respect to the stoking machinery is not so high as to warrant the purchase of a second machine, the best insurance against breakdown is the keeping of a reasonable and well-selected stock of "spares," when it will be found that any breakdown that may occur can be speedily put right. The maintenance charges in respect to the combined machine will be found to be very low; and it may safely be asserted that neither the bulk, the weight, nor maintenance difficulties can be advanced as arguments against the complete machine.

Fig. 6 shows a photograph of this machine, from which the general arrangement will be easily followed. The machine is designed for working in conjunction with a set of continuous hoppers having outlets fitted with slides arranged vertically in line with the retorts. The jaws at the back of the chamber form a special device for opening and closing these hoppers. The first part of the movement of the hand lever causes the arms to rise up and grip cleats fixed on the hopper doors, which are then opened upon the further movement of the hand lever. On pushing back the lever the reverse action takes place; the door first being closed and the levers then dropping out of the way to ensure clearance when travelling along the house.

The coal is fed from the hoppers into a specially-designed weighing chamber attached to the machine which automatically weighs the charges placed in the retorts; the weight being indicated on a dial arranged over the speed regulator on the operating platform.

(*To be continued.*)

YORKSHIRE JUNIOR GAS ASSOCIATION.

Annual Meeting and Visit to the Leeds Gas-Works.

The Annual Meeting of the Members of the Yorkshire Junior Gas Association took place last Saturday afternoon, at the Meadow Lane Gas-Works of the Leeds Corporation.

Prior to the meeting, the large party, in a persistent downpour of rain, inspected the works, under the guidance of Mr. W. B. Leech (the Manager and Chief Engineer), Mr. A. Edwards (Chief Chemist), Mr. G. H. Mitchell (Commercial Manager), Mr. H. A. Collett, Mr. C. Dougill, Mr. Walter Hole, and Mr. C. Payne.

The first point of attraction was the gas-furnace show-room, a comparatively new feature of the Leeds undertaking, which has been established to push the superiority of gas-furnaces for metallurgical purposes—in which Leeds industries are greatly concerned—over the coke-furnaces which have been chiefly used in the past. The rooms contained the best makes of furnace, in various designs to suit all purposes; and the great advantages in the way of heat regulation, time and labour saving, and invariable reliability for steel-working were demonstrated. This department of the undertaking, it was stated, has proved an immense success.

The visitors were next shown the equipment for receiving coke-oven gas direct from the Middleton Colliery Company. The gas, it was pointed out, was compressed at the colliery and delivered at the gas-works at Leeds under pressure. In case anything should happen to the outlet of the meter at Meadow Lane, and a stoppage occur, a safety seal has been introduced in the connection outside the meter, and has been so equipped that if the pressure at the Middleton end should temporarily fail, the gas would not be driven in the contrary direction—from Leeds to Middleton. The meter had a capacity of 75,000 cubic feet per hour. At Meadow Lane the coke-oven gas was measured crude. It had not been possible to put down an extra set of purifiers for it; so the Middleton gas was being worked in with the carburetted water gas, in order that any variation in the Middleton gas might be made good by the water gas, over which they had full control. It was found that a very satisfactory mixture resulted.

In the purifiers for the water gas, which the visitors next inspected, it was pointed out that up to now it has been expedient to use lime, which has to be renewed fairly frequently; but endeavours were being made to change over to oxide purification as soon as possible by fitting a Pickering connectionless valve. For checking the delivery of the coke-oven gas there are two Beasley recorders, working side by side—one on the mixed gas and the other on the coke-oven gas. On the water gas alone there is a fairly steady water line; but in the coke-oven gas it could not be quite so steady. In front of the recorders there is a little saturator, in view of the fact that the recording room adjoins the boiler-room; and the saturators thus help to steady the water line.

Continuing the tour, the visitors passed through the carburetted water-gas plant, which is of three units, each of 900,000 cubic feet per twenty-four hours. This is to be remodelled, under the scheme of modernizing the Meadow Lane works, to increase the capacity from 2,700,000 to 4,500,000 cubic feet per twenty-four hours. The engine-room, it was pointed out in passing through, contained two exhausters, each of 80,000 cubic feet per hour

capacity, one twin exhausting set removed from the coal-gas plant, of 200,000 cubic feet per hour; two high-speed steam-engines and blast fans, one patent tar-extractor driven by a 20 B.H.P. motor, and circulating water and oil pumps. There were two sets of condensers and washers—two of Clapham's water-cooled condensers, and four scrubbers, 5 ft. 6 in. diameter, by 30 feet high. The washers are fitted with two sprays—one at the top and one at the bottom. When the purchase of coke-oven gas was arranged, it was decided to use the relief holder for any excess that could not be immediately dealt with. After a very little time of working, it was found that the mixed gas was better than the water gas, which suggested that it was being admitted at the wrong place. Now it is admitted at the inlet to the condensers, and they are getting the full benefit of the carrying power of the coke-oven gas. The finish of the purification of the coke-oven gas and the water gas is by two oxide catch boxes, 35 feet by 30 feet by 6 feet deep, with 24-inch connections and Pickering's connectionless valve; the boxes being end to end and having a common division.

In passing to the water-gas meter, of a capacity of 85,000 cubic feet per hour (alongside which three coal-gas station meters are to be erected in a house), and the two gasholders, of 529,000 and 5,163,000 cubic feet capacity respectively, the party were shown a breeze-washing equipment. In the calorimeter house were seen a Beasley recording calorimeter for coal gas, sulphur test, &c. In the governor-house were three station governors; two compressing sets directly driven by gas-engines, 4000 cubic feet per hour each; two compressing sets similarly driven, of 20,000 cubic feet each; and one pressure-raising fan (Rateau) driven by a 4 B.H.P. motor, and capable of passing 150,000 cubic feet per hour against a 3-inch pressure difference. Each of these governors supplies practically a separate district. The conductors showed the installation of automatic pressure-wave controllers, in connection with the lighting and extinction of street-lamps, which have recently been adopted in the city. The great charm of the Rateau fan, it was stated, was that it was absolutely "fool proof."

The party moved forward to the tar-extractors—two Pelouze and Audouin extractors, of a capacity of 4 million cubic feet per twenty-four hours each. The tar passes through a set of atmospheric coolers, two loops of which, as an experiment, have been swathed in canvas, on which water is dropped in the summer time in the hope of reducing the temperature below air level. They have found this successful even in a very dry period.

In the exhauster-house there were two twin exhausting sets, each of a capacity of 200,000 cubic feet per hour; and the bed had been laid for a new Bryan Donkin turbo exhauster about to be erected of a capacity of 200,000 cubic feet per hour, with steam turbine, directly coupled. Particular interest was evinced in the waggon discharge by hydraulic capstan tipper which oscillated to suit the tip of the waggon when raised.

In the meter-house were seen two station meters of 110,000 and 70,000 cubic feet capacity per hour, which, when the new meter-house has been erected, would be transferred, and the site occupied by condensers for the new carbonizing plant.

The visitors passed through the inclined retort-house, containing beds erected in 1896. In the coke yard the telpher conveyor (Strachan and Henshaw's monorail type) was shown. This plant handles coke from both the inclined and the vertical retorts in another house. The coke screening and grading plant in the yard was also shown, by which the coke is fed into 100-ton storage bunkers by telphers and screened by Zimmer jigging screens into carts. The breeze separated is deposited by a rubber belt conveyor in an elevator which feeds it into an Allison grader, of a capacity of 10 tons per hour, the breeze being graded into three sizes—dust, smithy breeze, and walnut coke. The screens and grader are driven by 12 B.H.P. and 8 B.H.P. motors respectively. There the visitors were shown four benches of horizontal retorts, of a total capacity of 2,000,000 cubic feet per day, which are to be pulled down and the house converted into a coal-store. The last point of interest was the vertical retort-house, where there are two benches of intermittent retorts, each containing five beds of 18 retorts, 4 metres (13 ft. 1¼ in.) long; the total capacity being 2,300,000 cubic feet per day. No. 1 bench, it was stated, has been working since December, 1913, and No. 2 is in course of erection. There are twelve-hour charges of 9 cwt. each, and steaming goes on for the last two hours. There are step-grate furnaces, hydraulic capstan and waggon tipper, coal receiving bunker, elevator, and conveyor, driven by two 12 B.H.P. and one 8 B.H.P. motors, hydraulic coke-hoists, a hot-coke conveyor of the De Brouwer type, driven by a 12 B.H.P. motor, underground filtration tank for saving and re-using quenching water, the latter of which is now being built, and by which the filtered water will be raised to the overhead supply tank by a Rees Roturbo centrifugal pump directly driven by a 5 B.H.P. motor. The vertical retorts at present in use are producing about 13,500 cubic feet per ton of coal, and during the test period have, as a matter of fact, produced more than this. The No. 2 bench, in course of construction, proved of interest, by reason of the practical illustration of the structural features of the new retorts.

Annual Meeting.

The inspection ended, the annual meeting of the Association was held in the mess-room at the works; the retiring President (Mr. J. W. LEE, of Chesterfield) occupying the chair.

The PRESIDENT reported that 17 members of the Association were now serving with the Colours, and a large number in addition (several of whom, it may be mentioned, were present) had enrolled under the Lord Derby scheme, and were wearing the khaki armlet of the Army Reserve. The names of those actually serving were: Messrs. A. S. Balmforth, G. C. Bradbury, E. H. Bradbury, H. E. Bramer, J. A. Butterfield, C. D. Birks, G. Holdroyd, C. R. Ingham, J. Kennington, H. R. Lawton, J. Park, H. Pickles, C. Ratcliffe, R. Sutton, H. Townsend, H. Rayner, and H. E. Wilby. For some little time there had been thoughts in the mind of some members of the Association as to whether or not, in view of the heavy calls at present upon the time and energies of gas engineers, the Association should continue to hold any meetings. He thought he could safely say that most, if not all, of them had come to the conclusion that, so long as the meetings did not reduce their efficiency as workers for the country in the crisis through which it was passing, there was no possible reason why the meetings should be discontinued. They would, he thought, agree that, instead of the meetings tending to reduce efficiency, they undoubtedly increased it to a considerable extent. There had always been need for men engaged in a profession to meet and exchange views and experiences; but now, when the gas industry had been called to such unusually important work in the defence of the nation and the allied countries, the need was greater than ever before. The session just closing, during which he had been the President of the Association, had been one which had not called for a very great number of meetings. The beginning of the new duties to which they had had to get accustomed, and the reduction of railway facilities, had, naturally, had an effect against bringing members from all parts of the country together, and so had tended towards a reduced programme. Something of the same conditions would, he supposed, prevail in the coming session; but the Council had already got to work in preparing an attractive programme. The new President would give his Inaugural Address in January; for February they had invitations to visit more than one works; in March they were to have a paper entitled "Fuel Economy;" and a visit to a tar-extraction works was in view for April. His duties in the chair came to an end that day. All he had been able to do during his year of office had been a pleasure, even though it had meant, in his own case, rather more long-distance travelling than was usual for a President. He was quite sure that Mr. Demain, the new President whom they had in view, would come to the work with the keenness which had characterized the Past-Presidents. In the name of the members, he extended a hearty welcome to Mr. Demain. He (Mr. Lee) could only hope that when Mr. Demain retired he would be able to do so in a time when the conditions of the industry and of the country were very different from those of to-day.

The New President.

Mr. J. DEMAIN (of Garforth) then took the chair. Having briefly expressed his appreciation of the honour done him by appointing him as President, he said he knew that in gas-works, tar-works, and coke-oven works they were all very heavily engaged now; but he hoped they would do their best to keep the Association active, despite the difficulties of the time. They must not think, if a monthly meeting happened to be missed, that something was going wrong in the Association. He had great pleasure in moving a hearty vote of thanks to the retiring President for his services and his big sacrifices during the past year.

The motion was seconded by Mr. P. M'NAB (Hon. Treasurer), and carried unanimously.

On the motion of Mr. LEE, a hearty vote of thanks was accorded the other retiring officers.

Election of Office-Bearers.

The declaration of the vote for new officers was as follows:

Vice-Presidents.—Messrs. J. B. Balmforth and J. A. L. Cooper.
Hon. Treasurer.—Mr. P. M'Nab.
Hon. Secretary.—Mr. Ed. Garsed.
Assistant Hon. Secretary.—Mr. F. Peel.
Members of Council.—Messrs. J. W. Lee, W. Walker Atley, A. Edwards, S. C. Roper, F. Schofield, and E. J. Sutcliffe.
Hon. Auditors.—Messrs. A. Lister and G. E. Walker.

The Social Side.

The party then adjourned to the King Edward Restaurant, where, as guests of the Leeds Gas Committee, they enjoyed a substantial repast, in the course of which the thanks of the Association were accorded Mr. Leech and his Committee and officials.

Board of Trade and Coal Supplies.—The Board of Trade call attention to the probability that, owing to the increasing consumption of coal in industrial areas and the reduced output from mines due to the enlistment of miners, it will become necessary for many industrial consumers to draw their supplies to some extent from districts other than those on which they have been accustomed to rely. In order to maintain a regular and uninterrupted flow of coal, it is recommended that industrial consumers should, whenever possible, contract for their requirements, and not trust to the open market. Colliery owners on their part will, it is hoped, assist by making contracts for as much of their output as they can feel reasonably sure of maintaining. In view of the situation, it may be necessary for the Coal Exports Committee from time to time further to restrict the recommendation of licences in the case of coals which are in general demand for home consumption.

DEVELOPMENT OF THE BYE-PRODUCT AND COKING INDUSTRY OF GREAT BRITAIN.

In the report of the proceedings at the first general meeting of the Coke Oven Managers' Association, which appeared in the "JOURNAL" for Nov. 16 [p. 369], an epitome was given of the inaugural address of the President (Mr. George Chrisp). The full text of the address is now available; and in view of the interest attaching thereto, we give it *in extenso*.

EARLY HISTORY OF BYE-PRODUCT COKING.

The early history of the bye-product coking industry is a story of absorbing interest, recording, as it does, tremendous efforts of the pioneers in overcoming difficulties, breaking down prejudice, converting indifference, and acquiring knowledge from the hard school of experience.

Actually, of course, the first bye-product oven was the beehive; its bye-product being waste heat, utilized for steam raising. As a coke-producing medium, the beehive oven for the bulk of British coals still stands supreme; for we must admit that while the retort-oven with modern plant attached can produce satisfactory coke from coal which the beehive cannot utilize, it is rarely able to improve on what its old rival can do, so far as quality is concerned, with a coal suited to its methods of carbonization. The old system is, however, so wasteful that it is gradually being discontinued; but it is dying hard, after nearly 300 years of vigorous life.

We learn that the first British patent for extracting tar, ammonia, and the like from coal was granted to Sir Archibald Cochrane (Count Dundonald) in 1781; but little use appears to have been made of it. We are often accused of being far behind Continental nations in this industry; and though not admitting altogether the justice of the accusation, early development was certainly tardy. The chief reason was perhaps the abundance of material of super-excellent coking qualities in the coal measures of this country. Coke could be, and was, produced by primitive methods which for metallurgical purposes was ideal, and the originators of the bye-product ovens had the greatest difficulty in arousing the interest even of coke producers.

On the Continent (chiefly in France and Belgium) many of the coals possess in scanty proportions the fusible elements essential to coking; and other means than the beehives were necessary, as the hydrogenous matters were expelled by the slow combustion before structural decomposition of the coal had taken place. Hence the advent of the retort-oven, from which the coked mass could be rapidly expelled, the coke quenched outside, and a fresh charge of coal inserted. The heat of the walls was thereby retained to obtain rapid carbonization.

A French engineer, named Clovis Knab, is credited with being the designer of the first retort-oven. He erected a battery, with recovery of certain bye-products, in the year 1856, in France. Shortly afterwards, in 1861, the late Henry Simon interested himself in the oven, which had heating flues in the bottom only, and in conjunction with F. Carvès, another French engineer, introduced side-heating flues to Knab's oven. Mr. Simon, of course, is well known as having been the founder of one of our leading coke-oven firms, Simon-Carvès, Limited, of Manchester.

It was not until 1869 that the first plant appeared in this country. The difficulties met with at the outset seem to have been enormous; and generous tribute is due to the memory of men such as Henry Simon, Angus Smith, A. M. Chambers, Colonel (afterwards Sir S. A.) Sadler, Sir B. Samuelson, and others, who worked so strenuously to further the interests of the industry.

Ironmasters looked with suspicion on the coke obtained; comparing it unfavourably with the beehive product in mechanical condition and appearance. Some even asserted that its utility must be seriously impaired by reason of bye-products being obtained. Indeed, the structural defects were real, as, owing to the uneven temperatures obtained, and the strong suction kept in the ovens in those days, the coke produced was often spongy and soft. By reason of external quenching, its appearance was also against it. Trouble was experienced with the refractory materials used in construction. Some of these were unable to stand the high temperature and strains developed. Others expanded so much that wall collapse was frequent. But experience proved a sound teacher, and defects of construction and manipulation were gradually rectified. The chemist proved that the calorific power of the patent coke was equal to that of its elder brother, in spite of its dark complexion and unbecoming appearance. Markets were found for the hitherto almost unsaleable bye-products; and as prices were rising in consequence, the coke makers began to see possibilities, and the industry was established.

BEEHIVE PLANT V. RETORT-OVEN.

The owners of beehive plants were apparently alarmed at the progress recorded, and praiseworthy efforts were made to adapt existing sets to the developing conditions. As early as 1861 Jones and Blackwell attempted the recovery of bye-products from beehives, but without much success. In 1873 and 1879, a Scottish engineer, Aitken, achieved better results, by introducing a series of perforated conduits in the floor of his oven, through which the products of combustion were drawn, condensed, and scrubbed; the return gas being delivered inside the oven and there burned above the coking material. In England, in the year 1883, Jameson adopted similar methods very successfully.

The retort-oven continued to gain favour; and the introduction of the deferred payment system, whereby colliery proprietors were able to have plants erected at little risk or cost to themselves, undoubtedly accelerated progress. Indeed, the astute business methods of most erecting contractors, though frequently depreciated, had much to recommend them. The fact also that a higher yield of coke was obtained in the retort-oven assisted to arouse interest, promote inquiry, and, in some instances, cause astonishment, as it was argued that by the extraction of the bye-products the weight of coke must suffer.

One point made by the supporters of the beehive, and unfortunately incontrovertible, was that in treating the same coal the old system would produce coke containing less ash than the new. Even to-day one is occasionally told that dirt is "boiled out" in the beehive oven, and possibly actually shown a layer of ash lying on top of a coked charge as indisputable proof. The explanation (not always accepted) is that the ash observed is the residue of the coke destroyed by this method, and that the low percentage of ash actually in the coke is due to deposition of carbon from the volatile hydrocarbons decomposed in passing through the crust of coke which forms on the outer surface early in the coking period. The amount of pure carbon so retained is considerable, and has the effect of materially reducing the percentage of ash in the bulk. This deposit is obtained in lesser degree in the retort-oven, and is described as fur, feather, or hair, in different localities. Here may be noted a coking principle in which the retort and beehive ovens are at variance. A high temperature in the top portion of the retort would undoubtedly give a greater yield of coke, for the foregoing reason, but with disastrous results to bye-products.

Before proceeding further, it should be observed that modern and economic methods of coal washing have greatly influenced the progress of the coking industry; but this subject cannot be considered here.

THE SIMON-CARVÈS OVEN.

The Simon-Carvès oven was undoubtedly first in the field in this country; and its general principles may be observed in other and later types—considerably modified, however. Much costly, but useful, experimental work was done by the builders of this oven in regulating the dimensions to suit the coking qualities of different coals; and the axiom laid down, as a result of such experiments, was that the lower the coking power of the coal, the narrower the oven had to be.

In 1883, Mr. Simon introduced his recuperator—really a mild continuous regenerator—by means of which the air required for combustion was heated to about 500° C., "by causing it to flow around or about flues containing hot gases from heating flues of ovens." Combustion was effected in the sole flues, and the hot gases were then conducted to the upper portion of the side walls, and along horizontal flues with outlets to flues below, which communicated with the recuperator, after passing through which the gases were utilized for steam raising. This type, and modified forms of it, was generally adopted for nearly twenty years.

REGENERATIVE OVENS.

The vertical-flued regenerative oven, often called the German oven—although, as a matter of fact, Coppée appears to have been the originator of the vertical-flued oven, having erected batteries of these in Belgium in 1861, and introduced them here in 1873—then began to arouse attention. The Otto Company was formed in 1900; and their first plant was erected at Newport (Middlesbrough). The chief feature of their oven is that it is bottom-fired by the combustion of gas in a number of bunsen burners placed accessibly under the oven and distributed evenly, so as to ensure uniform heating and efficient utilization of radiated heat by the air required. This system met with such success that many other companies adopted similar methods; and the reversing regenerative oven is in general use to-day.

The recuperative power of the regenerative oven is a strong point in its favour, as heats can usually be brought back to normal after a stoppage much more quickly than is the case with the non-regenerative type. It is, however, a matter of doubt whether the advantages of the latter type outweigh its disadvantages. The writer wishes it to be understood that any criticism which follows is not directed at one particular system. But having, during the last ten years, had opportunities of observing the results from a battery of regenerative and another of non-regenerative ovens using the same class of coal, and subject to similar conditions, he may be allowed to state his opinion.

The horizontal-flued oven, usually constructed with a partition wall, is for that reason much stronger, as the heavy superstructure of the ascension pipes, valves, and mains receives adequate support; whereas the vertical-flued oven wall must necessarily be subject to crushing strain detrimental to its shape, and tending to shorten its life. The partition wall, of course, reduces the thermal efficiency of the horizontal oven, but permits of any one oven being repaired without undue interference with adjacent ovens. The whole of the flues are capable of inspection, and adjustments in the gas regulation are possible at any point. With many vertical-flued ovens this is not possible, and is a serious drawback.

It is claimed for the reversing regenerative oven that greater uniformity of heating can be secured. But if regenerated air is of any service at all, and as the temperature of the air by reason of the reversing principle must at one period be greater than at another, it follows that variation in flame temperature occurs,

with inevitable detrimental effect. Further, the effect of the changing-over is similar, as, the oven being alternately heated by flame and waste heat, there is periodic alternation of temperature; the heat of burned products of combustion being less than that of combustion. In the latest ovens of the Semet-Solvay type this latter objection is removed by the system of continuous regeneration.

A novel method of heating has been recently introduced by the Simplex Coke-Oven Company, which may be styled fractional combustion, and in which the whole of the air is admitted at one point and the gas joins at several, keeping up combustion. Also, in this case, the gas is fed from the top.

Another development of recent date is the coke-oven heated by blast-furnace or producer gas; the products of such distillation being utilized for power or lighting purposes, after extraction of the bye-products.

The introduction of the double main system, by means of which the rich gases evolved at certain periods are kept apart from the poorer gases and reserved for lighting, &c., must also be noted.

The progress of the coking industry, although tardy at first, has, therefore, been considerably accelerated in recent years, and with the growth of our metallurgical requirements in coke, and more especially the exhaustion of our best coking coalfields, must be continued, and further experimental work undertaken with a view to utilizing indifferent coking quality coal in order to meet such requirements.

Compressing Machinery.

One such experiment, the compressing machine—the introduction of which to this country is claimed by Mr. J. H. Darby, of the Coke-Oven Construction Company, in 1902*—has been an unqualified success, both as regards coking poor coal and reducing labour, as well as improving generally the coke produced. The desirability of coking compressed coal had long been felt, as it was noticed that the coke produced at the bottom of a charge was superior to the remainder; and this was attributed to the natural compression of the weight of the charge. Stamping by hand and the application of weights were the means first used, and, while certainly crude, they served to demonstrate that an improved cellular structure could be obtained, and a coke produced better able to stand the enormous crushing weight of a blast-furnace charge, yet sufficiently porous to accept the blast.

With the advent of the compressor of to-day, a 40 to 50 per cent. increased oven charge became possible, though later practice reduces this to about 25 per cent., as more taper and clearance are usually allowed for. The coking period is certainly increased; but the yields per oven of compressed charges still show an advantage over uncompressed. The increase in the weight of coke varies from 8 to 20 per cent., according to the locality whence the coal is derived; the increase being especially notable in Durham coals. Further advantages are: Lower production of breeze, the reduction of labour cost, higher yield of bye-products, and less inconvenience to the inhabitants of the surrounding districts.

Coke Handling and Quenching.

Marked improvements have also been made in the handling of the coke. The quencher bearing Mr. Darby's name did much to improve the colour of the coke; while various mechanical loaders are now on the market, most notable perhaps of which is the Goodall machine.

We thus see how the results desired by the introducers of the present coking methods have been achieved. Their objects were, briefly: (1) Production of good metallurgical coke; (2) utilization of inferior coal; (3) higher yield of coke; (4) economy of labour; (5) bye-products. We will now consider the latter.

Bye-Products Recovery.

At first, and for many years afterwards, the ordinary gas-works practice of ascension pipes and collecting or hydraulic main, with sealed dip-pipes, was followed. Owing to the heavy nature of the tar produced, these methods were decidedly troublesome to operate; and frequently as many as four, or even six, men were necessary to keep the main clear. Water or else weak ammoniacal liquor was circulated through the main until the experiment of substituting thin tar was tried. This experiment (usually credited to Colonel Sadler) was a great success, and, in conjunction with the disuse of the hydraulic-main dip-pipes—at that time considered a very daring departure—removed a fruitful source of worry and expense. The tar obtained was seldom, if ever, treated on the plant producing it prior to about 1900; but in recent years the advance in the value of tar products has been such that probably 50 per cent. of modern coke plants are equipped with tar-distilling installations.

With regard to the staple bye-product—ammonium sulphate—many changes in recovery methods may be noted. The "indirect" or "cold" process was until a comparatively recent date the general practice. The products of distillation being cooled, tar and a large percentage of the ammonia present are recovered and separated by decantation. The gases are then scrubbed by the virgin liquor so decanted and afterwards by water. A final washing by weak sulphuric acid is sometimes given, after the gases have passed benzol scrubbers. The ammonia liquor so produced was formerly treated by the intermittent process; large tanks, constructed like egg-ended boilers, being filled with a mixture of the gas liquor and lime water and subjected to heat, usually dry. The distillate was received in a sulphuric bath very similar to present practice.

The next stage was the use of smaller boilers working in series; and the introduction of the continuous stills of Gruneberg, Feldman, and Mallet formed really a natural development of this method. The salt produced by these means could not always be truthfully described as "good grey." But gradually matters were improved; dephlegmators were introduced, attention was paid to the general distribution of the ammonia gas in the saturators, and the evacuation of the foul gases, &c., until discolored sulphate became almost rare. The modern stills of Wilton, Walker, Spence, and others are capable of efficiently treating large quantities of liquor per day and producing first-quality sulphate. The types of saturators used during this period of development have not varied much—indeed, the old "hand fishing" pattern is in constant use to-day, and still finds admirers. The injector type of Wilton is largely used, as is also Walker's bottom discharge.

Direct Recovery Process.

Something of an innovation in the way of ammonia recovery as applied to coke-oven practice is the production of ammonia hydrate from gas liquor. This has been very successful, and if more generally adopted would certainly assist to keep up the price of sulphate. The most notable change, however, in the method of producing ammonia salt is the introduction of the hot or direct process. The idea of recovering ammonia from coal gas without the use of scrubbers was conceived many years ago; and as early as 1882 we find Bolton and Wanklyn taking out a patent for recovering ammonia direct from coke-oven and blast-furnace gases. Their process, briefly, was to admit superheated steam to the gases and cause the mixture to impinge on wire netting or perforated plates, so as to remove the tar and soot, and afterwards pass through perforated trays containing superphosphate, gypsum, or coke moistened with sulphuric acid.

If the gases were rich in ammonia, they were first passed over shallow pans containing sulphuric acid. Two years later, A. P. Price patented similar means, using as absorbent either H_2SO_4, H_2SO_3, or phosphates of soda, potash, and ammonia. Little interest in these methods seems to have been evinced, however, in spite of serious trouble arising with Rivers Board inspectors, by reason of noxious effluents evacuated into streams; and it was not until the introduction of the Koppers "semi-direct" process that attention was given to possible development in this direction. This process came in for somewhat severe criticism, notwithstanding which it has achieved considerable success. Although the deservedly popular direct processes differ from the semi-indirect in many essentials, yet the general principle is the same in each. Objections to the new process were made, to the effect that sulphate of good colour could not be obtained, and that benzol extraction would be difficult or impossible. The improvement in tar-extractors, however, has been such that tar fog can be completely eliminated, and so prevent discoloration of salt; while benzol recovery has been only slightly, if at all, impaired. The advantages possessed by the direct process are many, chief of which is the reduced cost of plant; while the saving of steam for evaporative or power purposes and the reduction or absence of effluent are both worthy of serious consideration.

The development of ammonia recovery does not end here, as only last year a patent was granted to Mr. J. M'Kenzie, of Middlesbrough, for a process for the manufacture of sulphate of ammonia direct from the sulphur and ammonia compounds contained in gases generated by the distillation of coal. It is well known that coal gas usually contains enough sulphur to combine with the ammonia present to form ammonium sulphate; and several methods have been suggested to obtain the synthetic action necessary, using heated oxide of iron as the catalytic agent. Mr. M'Kenzie proposes to use oxides of nitrogen to oxidize the sulphur compounds in the gas to sulphur trioxide. This, with the moisture in the gas (artificially produced, if necessary), forms sulphuric acid. The latter reacts with the ammonia to form $(NH_4)_2SO_4$. As the nitrogen compounds must be present in excess, the gases, after the ammonia reaction, are passed through 144° Twaddel acid, for their recovery. So far as the writer knows, the process is still in the experimental stage; but more no doubt will be heard of it shortly.

The almost universal use of hydro-extractors, or wizzers, for sulphate has had a beneficial effect on the market, as the produce can now be shipped to any part of the world, and there delivered without "bag rot" developing.

Benzol Recovery.

The recovery of crude benzol—a product the constituents of which are playing so mighty a part in the struggle to-day, and of such vital importance, not only to our great Empire but to civilization, that every extra gallon produced is a worthy achievement—has changed but little since its inception. Attempts have been made to freeze benzol out of coal gas; but the cost was found to be prohibitive, and the generally adopted method is absorption by creosote oil. The old intermittent system of distillation of the benzolized oil in pot stills (obtaining 30 per cent. benzol, which was subjected to a second distillation to reach the saleable 65 per cent.) was not altogether satisfactory. It not infrequently happened that delays in the first distillation occurred, with the result

* The Simon-Carvès Company claim priority in this direction, having erected a compressing machine for the New Monckton Collieries in 1900.

that the oil in circulation became so rich in benzol that no more could be taken up, and heavy losses ensued.

The introduction, some twelve or fourteen years ago, of the continuous system, by means of which 65 per cent. benzol is obtained direct, was of great practical value, as the constant flow of debenzolized oil to the scrubbers prevents saturation, and so minimizes loss. Various improvements have been effected in condensing and cooling arrangements by heat exchangers and the like, and to-day yields of benzol per ton of coal are much higher than formerly.

Modern coking plants are being equipped with rectification installations, and although at present few in number this side of the business will develop. One of the earliest rectification plants attached to coke plants was at Malton Colliery, Durham.

Since the introduction of the long ascension pipe and dry main, the amount of ammonium chloride in the soft pitch deposited there has been such as to command attention; and on many plants it is recovered by the simple process of digesting the pitch and concentrating the liquor obtained. For the latter purpose, the Kestner climbing film evaporator has been used; but the ordinary dry steam coil is still the favourite medium, and a good saleable product is obtained by this means.

The Past and Present Coking Official.

The development of the coking industry during the last thirty years has thus been very remarkable, and the evolution of the plant manager not less so. The coking officials of thirty years ago who could do more than merely write their names were exceptions rather than the rule. To-day the positions are occupied by men who have, by energy and intelligence, adapted themselves to changing and progressive conditions, and acquired such chemical and engineering knowledge and skill that they have earned the right to demand for their Association a place with the other scientific institutions of this country.

HAWKHURST GAS-WORKS RECONSTRUCTION.

In the early part of 1913, the Directors of the Hawkhurst (Kent) Gas Company, finding that the plant at their works had become totally inadequate for dealing with the increasing demand, consulted Mr. Andrew Dougall, of Tunbridge Wells, who advised the reconstruction of the works on modern lines. A scheme was prepared, and work on it was begun in March, 1914; Mr. Alec E. Whitcher being appointed Engineer, Manager, and Secretary to superintend the erection of the plant. In a communication which is published in the November "Transactions of the Society of Engineers," Mr. Whitcher describes some of his none too pleasant experiences when running the obsolete plant during the early winter, while supervising the erection of the new works.

The old plant had more than fulfilled its duty [the Company was formed as far back as 1868], and was practically beyond temporary repairs, but, of course, had to be kept going at any cost. What Mr. Whitcher says of his experiences during this period is quite sufficient to show that he was kept amply occupied. With regard to the retorts, these should have been renewed at least eighteen months before; and though every means of assisting the heats were adopted, these were of no avail. Stringent measures had therefore to be taken to maintain any supply at all; and in several cases of emergency he fitted on the foul main a $\frac{3}{8}$-inch iron cock, which was opened for about an hour after a charge, the exhauster thus drawing in a small percentage of air with the gas. While this was on, the jet photometer had to be closely watched; and it was found that the illuminating power of the gas was not reduced to any considerable extent. The average was 15 candles; and the yield per ton of coal was increased from about 10,000 cubic feet to 11,000 and 11,500 cubic feet, according to the urgency of the demand. The coal used at this time was Holmside, with a small admixture of cannel. This method assisted the purifiers, but could be adopted only in cases of emergency, as it would have been risky to have left its management to a stoker.

Coming to the brighter side of things, Mr. Whitcher says that the scheme provided for wholly new plant, with the exception of the station-meter and gasholders. It was so arranged that the whole of the 8-inch connections were separate from, and independent of, the old works. By means of bye-passing the old-plant supply at the station-meter direct into the inlet main to the holders, and coupling-up the new plant into the station-meter, both manufacturing plants were enabled to work into the holder at the same time. To ascertain whether the air had been expelled from the new plant, a blow-off tapping was made on the end of the new main before entering the meter. This consisted of a 1-inch main cock, to which was connected, at intervals, a length of pipe reduced to take a flat-flame burner—thus showing when all air had been discharged. The old plant was at the same time supplying rich gas; and as the new portion came fully into action, the old was gradually shut-down. The change-over took place without any hitch or deterioration in the quality of the gas supplied.

The new site (which gives plenty of room for future extensions) adjoins the old works. The subsoil is sandy, showing traces of clay, with a lower stratum of sandstone; and the foundations consist of a layer of concrete averaging 2 ft. 9 in. in thickness, and extending beyond the main walls from 6 to 9 inches. There are three courses of brick footings, of an average thickness of 2 ft. 6 in.

The retort-house provides for four settings of six retorts, and three of the arches have already been constructed. The depth of the furnace-floor below the charging floor is 7 feet. The mouthpieces are all self-sealing; and the ascension-pipes, bends, arches, and dip-pipes are 6 inches diameter. The foul-main is 8 inches diameter, and has one valve for each bed. Tar-pipes are fitted to the underside of each hydraulic pipe, leading to a Dillamore tar-tower. The settings are of the Gibbons regenerative type, and at present a bed of sixes is at work, and giving satisfactory results; there having been no trouble with stopped ascension-pipes, in spite of the high heats which have been maintained without variation since the setting was started. The average yield has been 13,000 cubic feet per ton of coal; the coal used being South Hetton small and Derbyshire. The fuel consumed averages 28 to 30 per cent.; the make per mouthpiece, 7000 cubic feet, according to the charges.

The coal-store adjoins the retort-house, from which it is divided by a wall, having semi-circular arched doorways. The store is divided into three bays with brick walls on both sides to a distance of 11 feet, making an opening in the centre of the store of 11 ft. 6 in. The ends of the walls have iron channelling to take timber partitions to separate the bays, if desired to keep different qualities of coal separate, and to reduce the danger of spontaneous combustion. The store when filled will contain a stock of coal sufficient for six months at the present rate of consumption. The coal is easily handled by the stokers, as each doorway is opposite a retort-setting.

The engine and exhauster house is built against the west end of the coal-store. The floor is concreted, with blue and red tiles set diagonally, giving a clean appearance; and the pipe-connections to the engines are covered with iron chequer plates to allow of easy access at any time. The new machinery comprises a 3½ H.P. gas-engine, and an exhauster of the rotary type, driven by counter-shafting, capable of passing 3000 cubic feet of gas per hour, supplied by the Bryan Donkin Company. The old gas-engine and exhauster, having been thoroughly overhauled, have been refixed in the new engine-house. Both exhausters are connected to a governor in the centre, which is provided with an automatic bye-pass for use when the governor is not in action.

There is a sulphate of ammonia plant on the direct system, by the Chemical Engineering Company. It comprises a vertical steam-boiler, together with an acid washer, through which the gas passes, containing serrated bars and mother liquor for extracting the ammonia from the gas as it is made. An overflow circulating pan, fed with sulphuric acid from an overhead tank outside, is provided with the washer. The pan has three divisions through which the mother liquor passes; two divisions containing fine cocoanut matting acting as a filter for the heavy tarry matter. The circulation of the liquor through the acid washer is effected by a small air-pump worked by steam. This also carries the liquor from the washer to the final supply-pan, whence it is run into the evaporating pan.

A Wilton still is also worked with this plant; the liquor being supplied from a small overhead tank. The ammoniacal liquor enters the still through a small funnel at the top, and passes through the chambers. The bottom is supplied with both wet and dry steam; and lime water is passed over from a lime sift and agitator, entering the still at the base. The ammonia passes from the still through a water-cooled supply to the acid washer, and thus the fixed ammonia is liberated. The only trouble experienced with the acid washer was when the mother liquor got above 46° Twaddel, when the washer became choked up; and to clear it, Mr. Whitcher drained off the liquor in the washer, and filled it with water. When the plant was first worked, trouble was experienced with discoloration of the salt, on account of tarry oil carried forward; but this was overcome by passing the liquor through a filter of silver sand before it entered the evaporator.

A Wilton's "Reflux" condenser-washer has been erected. This consists of several chambers, with six bubbling trays, each working with a seal not exceeding ½ inch. The hot gases from the hydraulic main enter the washer at the bottom, and pass upwards through all the six trays. The two upper trays are used in this case as a naphthalene washer by filling them with suitable solvent, such as paraffin or oil tar. The middle trays are provided with water cooling pipes. This apparatus is now, it is said, used in most small works on account of its low cost in comparison with condensers and scrubbers, which it equals in efficiency.

The three new purifiers, 9 feet square and 5 feet deep, were supplied by Messrs. Willey and Co. The valves, six in number, are of the Pickering type, placed below the ground floor, and boarded over. The purifiers are of the luteless type, and occupy what was originally the coal-store; the end portion of the house which formerly contained the retort-benches being now used as a turning floor for the oxide. A lifting-carriage runs on rails on top of the boxes, and is fitted with a screw pulley and wheels on either side. The 8-inch governor is of the compensating type, made by Messrs. Parkinson and W. & B. Cowan.

The new plant, when working at its full capacity, will be capable of making 30 million cubic feet of gas per annum, whereas the present make is about 10 millions.

Captain Richard B. G. Glover, who, as already stated in the "Journal," was recently killed in France, left estate of the value of £2166.

SIMPLIFYING ILLUMINATION CALCULATIONS.

By A. S. M'Allister.

[The Presidential Address at the Ninth Annual Convention of the American Illuminating Engineering Society, at Washington.]

As marking the transition of the science and art of illumination from the methods of the physicist to those of the engineer, no one milestone stands out more prominently than that represented by the presidential address of Dr. Clayton H. Sharp in 1907. Following his presentation of certain concepts and terminology in illuminating engineering, not only was there a change in the output rating of lamps from the indefinite and much-abused candle power to the definite and now well-understood lumen, but many improved methods were developed for solving problems in illumination. In many respects the results have been similar to the substitution of the flux method for the isolated unit pole method of solving problems in magnetism.

While from the point of view of physics there are marked differences between the concept of magnetic lines or "tubes" force and that of lines or "cones" of radiant energy, yet in their mathematical treatment the problems relating to the one are quite similar to those relating to the other.

So far as numerical results are concerned, it is absolutely safe to ignore the direction of travel and mode of propagation of the radiant energy from the source of light to the surfaces upon which this energy is absorbed. Of one relation we can be absolutely sure—namely, the total energy absorbed equals the total energy produced. When methods of calculation give results not in conformity with this relation, it is safe to state that the methods are wrong either in principle or in application. Thus for checking results obtained by more laborious methods, the absorption-of-light method is highly advantageous. In many instances—yes, in most cases—it is permissible to abandon the more complicated methods and rely upon the simplest and absolutely correct energy-ratio method, with merely an occasional reference to some more indirect method for determining the space distribution of the illumination where this is of importance.

Looking back over the "Transactions" of the Illuminating Engineering Society since its first meeting in 1906, one cannot but be impressed by the fact that almost all the solutions offered for problems in illumination have been based on the tacit assumption of point-sources rather than surface-sources. Even when dealing with plane-surface sources, the authors have usually treated them as made up of an infinite number of point-sources arranged in one plane, and have based their solutions on the "inverse square" law and other relations developed from the fundamental point-source conception. In order to obtain results consistent with the known facts in this case, it has been necessary to assign to each infinitesimal point-source in the plane certain physical characteristics not possessed by ideal point-sources, such as the ability to produce light in only one hemisphere which is the fundamental attribute of an infinitesimal plane-surface source.

It needs no argument to show that all calculations are immensely simplified by adopting initially the surface-source conception and utilizing at once the well-known relations developed for surface-sources.

Instead of determining the illumination produced by the source on a chosen plane by reference to the "inverse square" law and the integrated "candle power," the identical value can be derived more conveniently by means of the fundamental ratio existing between the "apparent luminous density" of the source and the lumen density on the surface illuminated, which ratio depends solely upon the solid angle subtended by the source when viewed from the chosen plane.

Allow me to call attention at this point to a fact learned by us all in our school days, but mostly forgotten since then—namely, the extreme ease with which solid angular relations can be represented by straight lines and circles in planes. As a result of this fact, simple circle diagrams can be utilized for solving graphically problems in solid angular relations the solutions of which become very complicated when any other method is employed.

Ignoring for the moment the physical interpretation of the change in conception from the "point" to the "surface" source, allow me to mention here the significant fact that the solution of a problem when based on the one conception is identical with that found when the other conception is employed; so that any errors which may be attributed to the one conception must likewise be urged against the other.

When dealing with surface-sources, it is necessary to take into consideration the fact that not all surfaces obey the so-called "cosine law" of emission in accordance with which a surface would appear uniformly bright when viewed from all possible locations. However, it is equally necessary to take into consideration the fact that the candle power from a so-called point-source, or the "apparent candle power per unit area" from a surface-source, is not uniform in all directions in space. The fact of the matter is that all practical sources emit light in such a way as to appear non-uniform in brightness over the surface when viewed from any one locality; and any one point on the surface apparently varies in brightness when viewed from different locations in space. It is impossible so to express the brightness that its value will not be subjected to the changes here referred to.

If the surface were ideally perfect in its emission, its brightness would be everywhere equal and uniform, and its apparent candle power would vary with the cosine of the angle of deviation of the surface from normal to the line of vision—that is, the surface would obey Lambert's "cosine law of emission." A surface which is not ideally perfect in emission can be compared directly with one which follows the cosine law of emission irrespective of the units in which the outputs or appearances are expressed.

For convenience in calculation and purpose of comparison, it is advantageous to express the outputs in terms of the lumens, and the output density in terms of the lumens per unit area. It is equally as convenient and logical to express the appearance in terms of the luminous output density, selecting for the unit the appearance of a surface emitting in accordance with Lambert's cosine law. For this unit of appearance there has happily been suggested the term "lambert," which is applied to the appearance of a surface emitting one lumen per square centimetre in accordance with Lambert's cosine law of distribution, and is equivalent in appearance to that of a perfect matt-surface of 100 per cent. reflecting power illuminated with a density of one lumen per square centimetre.

Although the introduction of the "lambert brightness unit" is of recent date, it is noteworthy that its exact physical definition was accurately presented before this Society eight years ago in the presidential address of Dr. Sharp, who stated therein that "the brightness of a diffusely reflecting or transmitting surface is proportional to the luminous flux which it emits per unit of area."

In view of the fact that the "lambert" unit is based on the surface-source conception, this method of expressing the brightness—that is, the appearance to the eye—seems to me to be fundamentally much more logical than the more common method involving a reference to the point-source conception. It is impossible to derive an expression of brightness which does not in some way—either directly or indirectly—involve the luminous output and the surface area. That is to say, when the expression of brightness includes a reference to the point-source conception, it is evident at once that there have been assigned to each infinitesimal point-source physical characteristics possessed exclusively by a surface-source. Simplicity in both conception and mathematical analysis dictate the reference of all brightness expressions directly rather than indirectly to surface-sources and not to point-sources.

Problems relating to both the output and the appearance of practical lighting sources are greatly simplified when use is made of the real surface-source conception rather than the fictitious point-source conception.

Independent in every respect of the units employed in expressing the output and the appearance of a surface-source, it is essential to recognize the fact that only in the case of emission in accordance with Lambert's cosine law is either the output density or the appearance uniform over the surface. For simplicity in calculation, it is advantageous to assign such values to these variables that the calculations will give results in practical accord with the actual facts. The mean value of the output density can evidently be found by dividing the total output by the total area of the emitting surface. This value is identical with the mean effective value of the "appearance" or "brightness" of the same source.

For all practical purposes the use of the mean effective value (in space) of the brightness introduces errors no greater than those caused by substituting the mean effective value (in time) of an alternating current for its cyclically varying value. That is to say, problems in illumination from surface-sources—and practically all sources are surfaces—are simplified by substituting the mean effective value of the output density and appearance for the actual values with their variations in space, in exactly the same manner and to the same extent as equivalent problems in alternating current phenomena are simplified by substituting the mean effective value of the alternating current for the actual values with their variations in time.

Let us carry the physical analogies somewhat further. The substitution of the lumen conception for the candle power conception has simplified illumination calculations just as the substitution of the magnetic flux conception for the isolated magnetic pole conception has simplified magnetic calculations. Moreover, the use of the surface-source conception rather than the point-source conception permits of the introduction of graphical methods of solving problems in illumination equally as accurate and convenient as the simplified circle diagrams now universally employed in solving problems relating to the general alternating-current transformer.

To persons familiar with the time-honoured laborious calculating methods of the electrophysicist and with the short-cut (but equally accurate) methods of the present-day electrical engineer, no arguments need be presented in favour of the simplified methods of solving problems in illumination other than the analogies just outlined.

The Committee appointed to report on the above address expressed their admiration for the lucid and convincing expression of the views therein contained. It is remarked: The underlying thought in the address is that illumination calculations can be greatly simplified by discarding the usual method of determining the illumination produced by the source on a chosen plane by reference to the "inverse square" law and the integrated "candle

power," and using the fundamental ratio existing between the "apparent luminous density" of the source and the lumen density on the surface illuminated, which ratio depends solely upon the solid angle subtended by the source when viewed from the chosen plane. The use of the surface-source conception rather than the point-source conception permits of the introduction of simple graphical methods for solving problems in illumination. The Committee "concur with the views expressed in the address and believe that the application of the method therein outlined will assist materially in the simplification of illumination calculations."

PLANNING OF LIGHTING INSTALLATIONS.

In determining the kind of lighting installation to be provided for any purpose, there are three general factors to be taken into consideration: (1) Physiological and hygienic requirements. The effectiveness of the light provided for producing illumination of a quality that will permit the eye to perform its functions satisfactorily and without strain or discomfort. (2) Economic requirements. Avoidance of useless waste of energy in the production of the light and its utilization. (3) The effect from an artistic standpoint. With this submission, Mr. R. F. Pierce lately opened an article in the "American Gaslight Journal" on the "Planning of Lighting Installations." After devoting some attention to the bad effects on the eye of improper lighting, he says that unfortunately the requirements of good illumination cannot be stated in such precise and measurable terms as to permit of the laying down of hard-and-fast rules which would govern every case. They may be stated only in general terms.

The first requisite is, Mr. Pierce continues, obviously sufficient light for the particular purpose, and under the particular conditions, for which it is needed. But proper or necessary illumination for any one purpose varies with conditions. A certain amount of light on a reading page may be sufficient where the surrounding walls are light, but entirely inadequate where they are dark, because the contrast between the bright page and the dark wall is objectionable.

The limits of brightness in the field of vision that are comfortable, or even tolerable, are a matter of contrast rather than of absolute values. Without endeavouring to make fine discriminations, we may at least lay down the principle that the tungsten filament, with its 1000-candle power per square inch, and the incandescent gas-mantle, with 60 to 90 candle power per square inch, are both so far beyond the limit of human endurance as to require effectual screening before being permitted in the range of vision. In general, it may be said that any installation in which the eye, in the ordinary course of observation, may rest upon a bare filament or mantle, is inexcusably bad, beyond the possibility of argument. Nor is the mere enclosing in diffusing glassware evidence that the objectionable brilliancy has been adequately reduced. An example of this is the electric flaming lamp with diffusing globe, placed 8 or 10 feet above the sidewalk. The brightness of the globe is about 40-candle power per square inch—one-half that of the gas-mantle. The mere fact that a globe is "diffusing" is of no importance, unless we know whether or not the diffusing does what is desired of it—that is, it reduces brightness within tolerable limits.

Generally speaking, we may say that light-sources are excellent in inverse proportion to their brightness—the brighter they are, the worse they are—assuming, of course, that sufficient light is delivered where it is needed. These two requirements may be met at the same time by the simple expedient of increasing the size of enclosing glassware. In fact, the virtues of the semi-indirect system of illumination lie mainly in the securing of low brightness by increasing the size of the enclosing bowl. Similarly, the merits of the indirect system are derived from the diffusing of the light from a very large surface—the ceiling—instead of a small one. Precisely the same results would be obtained by direct light through a diffusing artificial skylight; and likewise all the benefits of the semi-indirect system would be obtained by increasing the size of direct-lighting glassware to a sufficient extent—for instance, by using with the single-mantle small inverted unit an opaline globe of (say) 16 inches diameter. In other words, the indirect and semi-indirect systems are mainly mechanical expedients for reducing the brightness of the light-source. The object of decreasing the brightness of the light-source is to reduce the excessive contrast between the source and other portions of the room. While it is true that a certain amount of contrast is desirable, it is equally true that, with any of the lighting units now available or likely to be available, there is not even the most remote danger of insufficient contrast being obtained, at least in connection with any problem within the scope of any one but the specialist.

A safe practice for the salesman to pursue is to attempt in all cases to instal the equipment in which the light-source shall have the least possible brightness, consistent, of course, with sufficient illumination. In other words, the individual globes and shades should be of the largest sizes practicable. It will seldom be possible, with the commercial glassware now on the market, to reduce the brightness to the extent really desirable, except by resorting to the semi-indirect system of illumination; and, indeed, it is this fact that is responsible for the great vogue and rapid spread of the indirect and semi-indirect systems—the impossibility of obtaining relief from obnoxious degrees of brightness by using any of the commercial reflectors that are furnished for direct lighting.

Although the light-source may be effectively screened from the eye, it will produce the objectionable feature known as glare from the surface of glazed papers, &c. Such surfaces act as mirrors, by virtue of the regular reflection from the glazed surface; and a blurred, but quite brilliant, image of the light-source appears. The brighter the light-source, the brighter the image will be, and the more obnoxious the resulting glare. It is for this reason that the shading of incandescent gas and electric lamps by open bottom reflectors usually fails to produce satisfactory results in the lighting of offices, &c. The shading of lamps by such reflectors has no influence whatever upon the production of glare from glazed papers and other regularly-reflecting surfaces.

It is the smaller amount of "glare" from the less brilliant gas-mantle that is responsible for the lesser fatigue experienced in reading under a shaded incandescent gas-lamp than under a similarly shaded electric incandescent lamp. This effect is a matter of common experience, and has been quite generally noticed. All sorts of opinions and theories have been advanced in explanation; some enthusiastic adherents of gas lighting even ascribing it to some quality in the light itself. The perfectly obvious explanation does not appear to have received a great deal of attention.

Outside of colour (or quality, very loosely so-called) of the light, the importance of which has not been conclusively demonstrated, the above considerations are all that enter directly into the excellence of a lighting system with reference to ease of vision and the health of the eye. In addition to these, however, another feature, and a very important one from the commercial standpoint, is artistic effect. The average purchaser of lighting appliances is not so much interested in securing facilities for performing a certain kind of eye-labour, as in providing himself with pleasant surroundings; and personal tastes must be met before the physical requirements of illumination may be considered. Not much success will attend the salesman who attempts to sell lighting appliances with a single eye toward simplifying stock records in the storeroom. It is impossible now to discuss æsthetic or artistic considerations at length. It is only necessary to call attention to the importance of these considerations, and emphasize the need for giving them due attention.

Coke-Oven Managers' Association.

The next meeting of the Association will take place in the Applied Science Department, St. George's Square, Sheffield, on Saturday, the 18th inst., when Mr. G. Taylor, of Silverwood, will read a paper on "Benzol." The Secretary (Mr. J. T. Price) states that membership of the Association is increasing rapidly; and it is intended to form local branches or groups, as soon as most of the managers can be enrolled. Each branch will then hold local meetings, and all branches will meet together annually at some selected centre. The first annual dinner will take place in Sheffield on Jan. 15. At a recent Council meeting, it was decided (apart from these engagements) to alter the time of the meetings to the last Saturday in the month.

A Salesman's Handbook.

Great assistance should be derived from the "Salesman's Handbook" which has been prepared (and is now on sale) by the National Commercial Gas Association, of No. 61, Broadway, New York. It is pointed out that the book should really be called a "service," inasmuch as it will extend over a period of five years at least, and furnish a reference and data book kept continuously up to date by the issue of new pages and the revision of old ones. The service consists of a desk file in which are placed pages of the book not in current use; a leather binder in which are kept the pages to which the user most frequently refers; and the book proper which consists now of approximately 600 pages, divided into ten sections dealing with the various branches of gas supply, and giving tables, technical terms, &c. The price for the outfit, $7.50, includes the mailing of all future pages issued within the period named.

The Coal-Tar Dye Industry.—Dr. F. A. Mason contributed to last month's number of "Science Progress" the first part of an article on "The Influence of Research on the Development of the Coal-Tar Dye Industry." An interesting account is given of the origin of the industry in this country, and especially of the parts played by Perkin, Hofmann, and Caro. Dr. Mason makes it clear that the reason why the industry, although it was started, and for a time made considerable and promising progress in this country, subsequently became the monopoly of Germany, was the dearth of British students of organic chemistry. "Both by nature and good fortune," he writes, "England seemed to be destined to be the great coal-tar dye producing country of the world. Great Britain produced more tar than any other country. The first synthetic dye was discovered here; and Professor Hofmann himself, at the Royal College of Chemistry, was the centre of attraction of the industry. But one thing only was lacking—namely, a sufficient scientific education of the general public, such as was already obtaining in Germany, and a sympathetic understanding and appreciation of the methods and objects of research. To this last is to be traced, directly and indirectly, the ultimate collapse of the British dye industry."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Price of London Pitch.

SIR,—We thank you for your reply to our letter [inserted in your issue of Nov. 23], and shall be under further obligation to you if you will be good enough to publish our criticism thereon.

We have no doubt that the contracts shown to your reporter were *bonâ fide;* but we should have preferred that he had stated the actual dates of same. You speak of transactions indicated in reports of Sept. 6 and Oct. 4, and later refer to sales made during August and September. May we point out that we have dealt with the averages of September and October only; and we fail to see the relevancy of sales made in August. You admit that the price "drooped" in October; but we have searched your weekly records in vain for any admission of a possibly lower price than 26s., even as lately as Nov. 30. Your reports are headed "Current Sales of Gas Products" under a given date, and are understood to refer to the week ended prior to the issue of each "JOURNAL." How can sales made in August and September hold the field till the end of November, when the market has meantime "drooped?" We agree that pitch for home trade can be taken into consideration of material importance, but not unless the pitch is obtained from London supplies. It is not a question of British pitch, but London pitch; and it is known that, compared with export, London consumption is relatively insignificant. We agree that the domicile of a buyer does not matter, provided that he buys on London terms; but we submit that sales to foreign buyers on "delivered terms" cannot be brought to a London price until the transaction has been completed, which may be months afterwards. Had your reporter said that sales to foreign buyers "influenced" the London prices, we should have been prepared to agree with him.

We claim that, on your own showing, the actual prices in London were materially lower than indicated in your reports, and are confident that if the fullest investigation could be made, and the actual prices week by week be taken for the months of September and October, our figures would be approximately correct.

We can, of course, now see that your November reports from the same source are open to the same objections.

BLAGDEN, WAUGH, AND CO.

4, *Lloyds Avenue, E.C.,*
Dec. 3, 1915.

[Messrs. Blagden, Waugh, and Co., in their former letter, remarked "During the past few months, however, we are sorry to state that the prices of pitch given under the London section are beyond our comprehension," and proceed to doubt in particular the figure of 26s. per ton. Our reporter thereupon verified with rather full information the transactions already indicated in our columns at 26s., which Messrs. Blagden, Waugh, and Co. now admit as accurate by saying they do no doubt the *bona fides* of the contracts in question. Our reporter, while he enjoys our confidence, will continue to give information representative of the market; but it must be clearly understood that neither the views of merchant buyers nor unimportant sales under special conditions, either for export or home trade, necessarily reflect the real value of London pitch. The largest makers, being the most important of sellers, have a natural right to be heard. At the last moment our reporter has been able to verify other sales of London pitch on the 2nd and the 25th of October for export—leaving the sellers an undoubted 26s. net per ton f.o.b. producing works. Our reporter puts the average value of London pitch for the months of September and October at 24s. 6d. per ton, compared with Messrs. Blagden, Waugh, and Co.'s figure of 20s. per ton. Our reporter is assured that even so recently as last week a large London maker sold a considerable quantity of pitch at 20s. per ton net at his works, which throws the gravest doubt on the assertion made last week by Messrs. Blagden, Waugh, and Co. in our columns that "makers in London would still entertain figures last quoted—viz., 17s. to 18s." Readers would expect the above quotation (17s. to 18s.) to refer to London makers generally, whereas it probably referred to an unimportant quantity, *ex* a comparatively small works.—ED. J.G.L.]

Lighting of Works' Yards.

SIR,—In one of the "Editorial Notes" in your last issue [p. 473], you again refer to the minimum illumination of 0·05 foot-candle for open-yard lighting recommended by the Home Office Committee on Factory Lighting; and you now suggest that, although this might be sufficient for "open spaces," a higher minimum would be preferable for "dangerous parts" of a yard.

Actual measurements in well-lighted yards (of which I have made a good many) do not, however, bear out your contention; and they tend to show that for "dangerous parts"—*e.g.*, where shunting-engines are moving, and rails and points form stumbling blocks—0·05 foot-candle as a minimum is ample, and this figure might well be diminished for more open, and therefore less dangerous, places.

It was in the hope of convincing you and others that an illumination of less than 0·05 foot-candle is in no sense in the danger zone, that I mentioned (in the recent discussion at the Illuminating Engineering Society) the figure of 0·035 foot-candle on the floor of your publishing office. No one could seriously contend that the floor is dangerous to walk about on, or that anyone could possibly stumble over an object on the floor; and I venture to think that in desiring a minimum higher than 0·05 foot-candle, you are labouring under a mistaken idea as to the degree of illumination which this figure represents.

I agree entirely with your differentiation between "open spaces" and "dangerous parts." But I think you will find that the Committee have forestalled you in drawing this distinction; for they make it clear that for open spaces which are not dangerous they would be content with "beacon" lighting, and do not specify a minimum at all.

ARTHUR CUNNINGTON.

26, *Muncaster Road, Clapham Common, S.W.,*
Dec. 2, 1915.

Enlistment of Gas-Works Employees.

SIR,—With further reference to the question of the enlistment of gas-works employees, a letter (of which a copy is appended) has been received from the Board of Trade.

In the list of occupations which was enclosed with the letter, "Gas-Works Service" is included under List D—"Occupations (Reserved Occupations) of Cardinal Importance for the Maintenance of Some Other Branches of Trade and Industry."

A note applying to "Gas-Works Service" reads as follows: "Public utility services—gas, electric light, and power corporations, water-works, tramways, and canals. Skilled men in these undertakings, if attested and classified in Section B (Army Reserve), will not be called up for actual service with the Colours unless their employer states that their services can be spared."

WALTER T. DUNN,
Secretary, Institution of Gas Engineers.

39, *Victoria Street, S.W.,*
Dec. 1, 1915.

[ENCLOSURE.]

Board of Trade (Department of Labour Statistics),
Gwydyr House, Whitehall, S.W.,
Nov. 29, 1915.

RESERVED OCCUPATIONS COMMITTEE.

Dear Sir,—With reference to your letter respecting recruiting, I have pleasure in enclosing herewith a list of occupations which, in one way or another, have been reserved from recruiting at present.

Any men belonging to these occupations should be formally attested under Section B (Army Reserve); and they will not be called up as long as they are indispensable in their respective employments.

(Signed) F. H. M'LEOD.

Prices of London Creosote.

A question was recently raised by a correspondent as to the prices quoted for creosote in the pages of the "JOURNAL," and possibly some explanation will satisfy others interested in the subject.

It may be pointed out that the quotations given in our columns for London refer to products made in the London district, and not to materials imported from the country. For many years, supplies of country liquid creosote have come to London, and have usually been sold below the London price. The quantities so imported, however, do not influence the London value—being relatively small compared with the vast London production, which latter is almost entirely a salty creosote. For a long time past, creosote salts have been worth more than liquid creosote.

There have been a number of sales of London creosote for local consumption at over 4d. net per gallon; but as buyers purchase in fairly substantial quantities, transactions do not take place with much frequency. Moreover, numerous exports are of less than a million gallons each—a quantity which the correspondent referred to above maintained it was necessary to have for disposal to get 4d. per gallon, and that one should also be able to secure a tank steamer for the conveyance of same to America. We learn there has been little difficulty in obtaining tank steamers for the traffic.

After all, so far as London produced oil is concerned, the question is what is the value actually obtained for the very large quantity turned out by the chief makers here. From indisputable information in our possession, we are able to state that for some months past the average price has never been under 4d. net per gallon, and much has been sold at 4¼d. and over.—ED. J.G.L.

Dublin Electricity Station Wrecked.—In the early hours of the morning last Saturday week an accident occurred in Dublin in the neighbourhood of Forbes Street and Sir John Rogerson's Quay; one of the sub stations for the Corporation electricity supply being wrecked. The whole of the brickwork of the building was scattered in all directions. Much damage was caused to adjacent premises; and the oil-tanks and switches were enveloped in flame. It was at first thought that the occurrence might have been due to an accumulation of gas beneath the station—a gas-works being near by. The brief accounts of the matter appearing in the Electrical Press make no definite pronouncement as to the cause; but a statement has been made that it was due to an "unusual and mysterious bursting of a transformer."

Public Lighting Difficulties at Stockport.—Minutes submitted at the monthly meeting of the Stockport Town Council stated that the Chairman of the General Purposes Committee had instructed the Gas Engineer (Mr. S. Meunier) to light one-half of the lamps in the borough, and that 1237 lamps were up to Nov. 19 being lighted out of a total of 2900. The delay in putting the lamps into lighting appeared to be due to shortage of labour. One or two councillors remarked that the lighting was not all it might be; but Mr. Winter (the Chairman of the Gas Committee) assured the members that everything possible had been done. They were prepared at the gas-works to take on a hundred men; but they could not get them. The Committee were willing to light all the lamps, if the Council would find the labour. It was pointed out that 250 automatic lighters had been ordered, and the procuring of another 500 was contemplated.

REGISTER OF PATENTS.

Production of Ammonia Compounds.

RIGBY, T., of Dumfries, and WETCARBONIZING, LIMITED, of Dean Farrar Street, Westminster.

No. 18,558; Aug. 11, 1914.

This invention relates to the production of ammonia compounds by the employment of peat as an absorbent or fixing agent, as in the recovery of bye-products from gas generated by the gasification of nitrogen-containing fuels, such as peat.

As a result of experiment, the patentees claim to have found that peat, which in a wet condition has been subjected to heat to produce without evaporation such a change therein as renders the bulk of its water readily expressible, as in the process of wet carbonizing [for example, patents Nos. 10,834 of 1903, 17,610 of 1911, 17,427 of 1912, 5873, 9392, and 11,133 of 1913], is capable of absorbing ammonia and converting it into a compound of ammonia with humic acid or analogous materials of sufficient stability not to part with ammonia certainly at temperatures below 100° C., and probably not even until a much higher temperature is attained. Accordingly, they employ peat which has been heat-treated in the above way, as an absorbing or fixing agent for ammonia, and especially in connection with the absorption of ammonia from the gases of ammonia-recovery gas-producers.

The invention may be carried into effect in conjunction with processes for peat gasification, as described in patents Nos. 17,610 of 1911 or 25,146 of 1912. The results obtainable under any particular conditions depend largely upon the character of the peat itself. Thus it is found that a well decomposed peat containing a large percentage of ash was incapable of absorbing ammonia to any appreciable extent—apparently owing to the humic acid in the peat having been neutralized by the alkali in the ash. By exposing a young heat-treated peat in a fairly dry and dusty condition to ammonia-containing gases they have, however, been able to increase the original content of fixed nitrogen in the peat from 1·25 to 4·5 per cent., and in one case even to as much as 7 per cent., "which would indicate that the greater the amount of free humic acid in the peat, correspondingly greater will be its power to absorb the ammonia."

Apart from the reduced cost of thus preparing peat for use as an absorbent or fixing agent, which the method renders possible—especially when considered in connection with peat-treating processes of the character above indicated—the fixed nitrogen is rendered available in the product in an easily assimilable form for manuring and fertilizing purposes, apparently owing to the destruction of the slimy matter and the rendering truly spongy of this organic material.

Eliminating Sulphur from Oils.

EVANS, E. V., and the SOUTH METROPOLITAN GAS COMPANY, of Old Kent Road, S.E.

No. 22,147; Nov. 6, 1914.

The patentees point out that it is known that when the vapour of oi containing sulphur is heated with hydrogen an elimination of sulphur as sulphuretted hydrogen, occurs, and in one process which takes advantage of this fact the hydrogen is produced by mixing the oil vapour with superheated steam and passing the mixture over coke heated to redness—the coke at the same time producing intimate contact between the steam and the oil, which is cracked at the temperature used. By the present invention, the whole or a part of the sulphur present in an oil may be eliminated as sulphuretted hydrogen by heating the oil in the presence of hydrogen or gas containing free hydrogen and a catalytic agent or contact substance.

In the case of an oil of suitable boiling point, the vapour of the oil mixed with a small proportion of hydrogen (5 or 10 per cent. of its volume) may be passed over the heated catalyst and the sulphuretted hydrogen may be removed from the vapour by absorption by any known agent for the purpose, or the oil may be washed after condensation to the liquid form.

The process appears to be applicable, the inventors state, to all oils containing sulphur. The most efficient temperature of working is in the region of 400° to 500° C.; for at this temperature the iron pipes which contain the catalyst are not destroyed, and the velocity of the reaction is so high that a relatively small area of contact is required. On the other hand, certain oils are decomposed at these temperatures; and when this is to be avoided, lower temperatures must be employed. To this end a relatively greater surface of contact will be necessary, in order to bring about a similar effect as at 400° to 500° C. It is necessary, therefore, to determine with each particular oil the maximum temperature below 500° C. at which the oil is not decomposed, and to allow sufficient contact with the catalyst to ensure that practically the whole of the sulphur of the oil is converted into sulphuretted hydrogen The deposition of carbon on the catalyst is not a measure of the extent of the decomposition of the oil; for the sulphur compounds on decomposition yield carbon. The yield of oil before and after treatment is the criterion from which the extent of the decomposition must be judged.

Certain substances act catalytically in promoting the decomposition of sulphur compounds. Nickel, iron, cobalt, copper, and a number of other substances (that have from time to time been proposed for the decomposition of sulphur compounds in coal gas) deposited in porous nuclei, or used as such, may be regarded as catalysts to the decomposition; while such substances as pumice, fire-clay, asbestos, &c., appear only to act as promoting contact, and are termed simple contact substances. The effect of a catalyst is to reduce the contact necessary, and thus the size of plant; and the superiority of reduced nickel, impregnated on a porous medium, such as fire-clay, over (for example) asbestos used as a contact substance, is very marked.

Hydrogenation of the oil does not take place, probably owing to the "poisoning" effect of the sulphur on the catalytic or contact action.

As a typical example of the application of the process, it may be assumed, the patentees say, that naphtha is being distilled from crude coal tar. The vapours from the head of the still or at the exit of the fractionating column or dephlegmator, if used, are conducted to a furnace maintained at 450° C., and in which steel or iron pipes are contained. A convenient arrangement for these pipes is in the form of a U. The vapours enter at the top of one limb, and in descending are brought to the temperature of the reaction; and to enhance this, the limb may be packed with non-combustible material. In the second limb, the catalytic material is placed. This may be prepared by steeping highly porous fire-clay spheres, about 1 inch in diameter, in a saturated aqueous solution of nickel chloride, and reducing the salt by subjecting the spheres to a stream of hydrogen or coal gas at a temperature of 300° to 350° C.

Assuming that the rate of distillation is 50 gallons per hour, then the volume of each limb of the U tube should be about 7·5 cubic feet. It may be advisable to attain the volume required by a multiple of smaller tubes; and the former or preheating limbs may be advantageously filled with fire-clay spheres which have not been steeped in nickel salt solution.

A stream of hydrogen or coal gas is introduced at the inlet of the preheating tube or tubes, and allowed to flow with the vapours at the rate of about 400 to 500 cubic feet per hour when the rate of distillation is 50 gallons per hour. Only a small portion of this hydrogen is actually used; and it is advisable to pump the hydrogen over in a closed circuit consisting of reaction tubes, vapour condenser and receiver, meter, pump. The sulphuretted hydrogen produced, as a result of the decomposition of carbon bisulphide and sulphur compounds, is washed from the condensed vapour by caustic soda solution, or may be extracted direct from the vapour by means of an oxide of iron purifier kept sufficiently warm to prevent condensation. The periodic revivification of the catalytic material may be conducted by aeration in the usual manner.

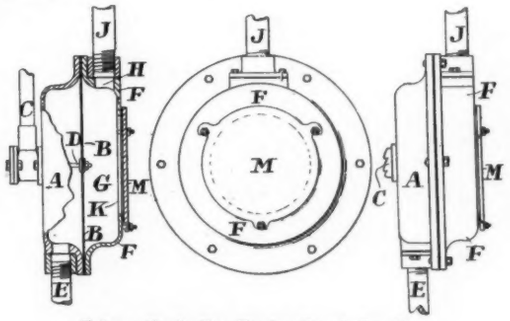
In the case of an oil which cannot be distilled, or, indeed, of an oil capable of distillation, the catalytic substance may be introduced into the liquid oil, which is suitably heated while hydrogen is passed through it; or the heated oil may trickle over the contact substance while hydrogen is at the same time passing over it. As already stated, hydrogenation does not occur.

Gas-Bags for Gas-Engines.

FAIRWEATHER, W., J., & W. R., of Blenheim, New Zealand.

No. 20,594; Oct. 6, 1914.

The gas-bag or regulator according to this invention consists in the combination of a casing, one side of which is closed by a substantially flat diaphragm, a valve (actuated by the movements of the diaphragm; and arranged on the side of the casing opposite the diaphragm) controlling the supply of gas to the engine, a gas-outlet between the diaphragm and the valve, a rigid cover extending over the diaphragm on the side away from the valve, and an inspection opening normally closed by a gas-tight cover.



Fairweather's Gas-Engine Regulating Bag.

A cross-sectional elevation of the gas-regulator, and a back and side elevation are given.

The regulator is formed in the usual way with a solid metal wall A with a flexible wall B of fabric material. C is the gas inlet controlled by the valve D attached to B, and opened and closed as the fabric is drawn in and bulged out by the exhaustion and filling of the regulator casing. E is the outlet from the regulator for conveying the gas to the engine. It is between the diaphragm and the valve. F is a metal cover secured over the back of the wall B by bolting its flange to the flange of the wall A—the edge of the fabric being held between the two flanges. The cover is shaped so as to leave sufficient space G between its inside and the back of the fabric to permit of the full distension of the wall B in the working of the engine. It is formed with an aperture H at the top, from which a pipe J is led away to any desired point.

The cover is formed with an inspection opening K that is normally kept closed by the plate M fitted over it and secured by the nuts to make a gas-tight joint.

Using Exhaust Steam in the Manufacture of Water Gas.

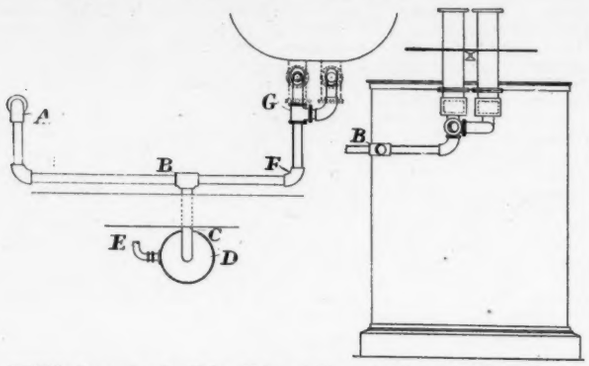
SMITH, H. E., of Putney, S.W.

No. 23,052; Nov. 25, 1914.

This invention relates to the intermittent type (alternate "run" and "blow" type) of water-gas producers, as described in patent No. 24,893 of 1908, in which the superheating of the steam is carried out, with the object of providing for the utilization of exhaust steam without superheating.

The air blast to such plants is usually provided, the patentee says,

by a steam-turbine coupled to a fan kept running continuously while the plant is at work, although the "blow" is only required for about one minute in every six. A continuous stream of exhaust steam from the turbine is therefore allowed to escape to the atmosphere in excess of the amount required for gas making. To enable this exhaust steam to be utilized, the inventor arranges an intervening liquid seal between the turbine and the inlet valves of the producers.



Smith's Apparatus for Using Exhaust Steam in Water Gas Manufacture.

A side elevation of a portion of an intermittent water-gas plant is given; also a plan of same.

To the exhaust pipe A on a steam-turbine, there is fitted a T-shaped connection B; and to the lower end of the latter is connected a depending pipe C the open end of which is caused to dip into a liquid seal contained in a seal pot or vessel D provided with an adjustable overflow E, in order that the amount of seal on the pipe may be regulated to suit different requirements. From the other end of B a pipe line F is carried to the inlet steam-valves G on the water-gas producer.

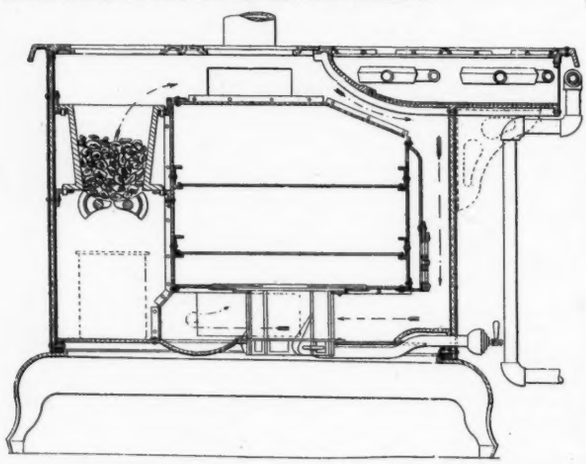
With a double generator plant the steam-valve may be in the form of a four-way valve by which the current of exhaust steam coming from the turbine during the "blow" can be given free outlet into the atmosphere, and thus relieve the turbine of back-pressure during the periods when the utmost output is required. By a turn of the valve G to the right (or left), the current of steam can be directed into either of the generators as required as soon as the "blow" is ended. The required pressure for this steam can be freely adjusted by the depth of the seal in D, and the inlet valve G can be so restricted that any excess of steam in the pipe A escapes at the seal-pot D.

Combined Solid-Fuel and Gas-Burning Stove.

LINDEMANN, A. J., and the A. J. LINDEMANN AND HOVERSON COMPANY, of Wisconsin, U.S.A.

No. 23,680; Dec. 7, 1914.

This invention relates to a stove designed for baking and over-fire cooking, so as "to economically provide simple, compact, seam-tight, and efficient stoves, each constructed to permit the use of either solid or gaseous fuel without necessitating the removal or replacement of any of its parts, and in which both kinds of fuel may be utilized at the same time." A novel flue system of the stove serves, it is said, for ample draught for the combustion of the solid fuel, gas, or both, as well as to economize space for chambers in which are located the gas-burners for oven-heating and over-fire cooking, so that none of the products of combustion of the solid fuel can enter the chambers.



Lindemann and Hoverson's Combined Solid-Fuel and Gas-Burning Stove.

The structural peculiarities of the stove will be apparent from the accompanying illustration—a vertical longitudinal sectional view.

The specialities claimed are: Mechanism for adjusting a plate to act as a gas-flame deflector or to shut off the flame from the oven, and mechanically adjustable to control the communication of the gas-burner chamber with the oven; a gas-burner chamber disposed below the bake-oven and secured to the bottom of it—the chamber extending across a flue-space in the stove between the bottoms of the oven and the stove; and an operating rod extending beyond the wall of the stove with a toggle-joint connecting the operating rod with the plate. A flue conducts the products of solid fuel combustion from the fire-pot of the stove around and under the oven; while the gas-burner located beneath an opening in the bottom of the oven, with a vertically movable plate for controlling the opening, permits it to be either open or closed above the burner, so as to constitute a flame-deflector when elevated above the oven-bottom. The chamber in which are the gas-burners is isolated; the bottom of it comprising a partly horizontal and partly curvilinear solid plate shaped at the upper extremity of its curve to form a ledge upon which to rest a removable top-plate of the stove, whereby the plate constitutes a supplementary part of the top-frame of the stove.

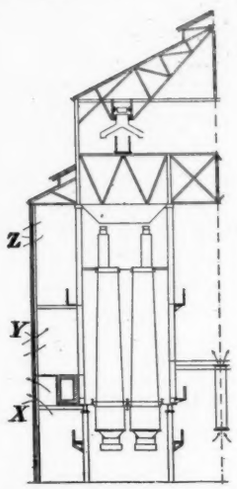
Ventilation of Retort-Houses.

DUCKHAM, A. M'D., of Ashtead, Surrey.

No. 24,289; Dec. 18, 1914.

Trouble has been experienced, the patentee says in his specification, with the ventilation of retort-houses installed with vertical retorts. The air entering on the ground level becomes heated by contact with the supporting ironwork and mouthpieces around the bottom of the retorts from which the coke is discharged, and is further heated by contact with the brickwork forming the bottom and sides of the settings. This heated air ascends, and causes inconvenience to the attendants working on the intermediate platforms and on top of the settings.

To remedy this defect, he proposes to cover over at the most convenient position up the sides of the settings, the space between them and the retort-house walls, so preventing the ascent of the hot air. In order to ventilate any stages that may be formed between two benches of settings, air-ducts are constructed from these stages, running downwards to such a level above the ground floor that cool air only enters, or the ducts may be extended to the outside of the building. The cool air is then admitted through the floors of such stages, which act as covers to exclude the heated air.



Duckham's Arrangement for Ventilating Retort-Houses.

A vertical section of a retort-house constructed according to the invention is shown. Openings X are provided in the outer walls through which the air, heated by contact with the bottom of the settings, can escape. Through other openings Y Z cooler air can enter from outside for the ventilation of the intermediate platforms C and platforms D at the top of the settings. A cover B, between the settings and the outer walls, shuts off the space above it ventilated by the air entering through the openings Y from the space below.

For the purpose of ventilating stages between two benches of settings, ventilating shafts E are carried downwards to a level which ensures the supply of cool air. The tops of the shafts would be covered by gratings. In this case the raised floor F acts like the cover B, and the cool air is passed through it.

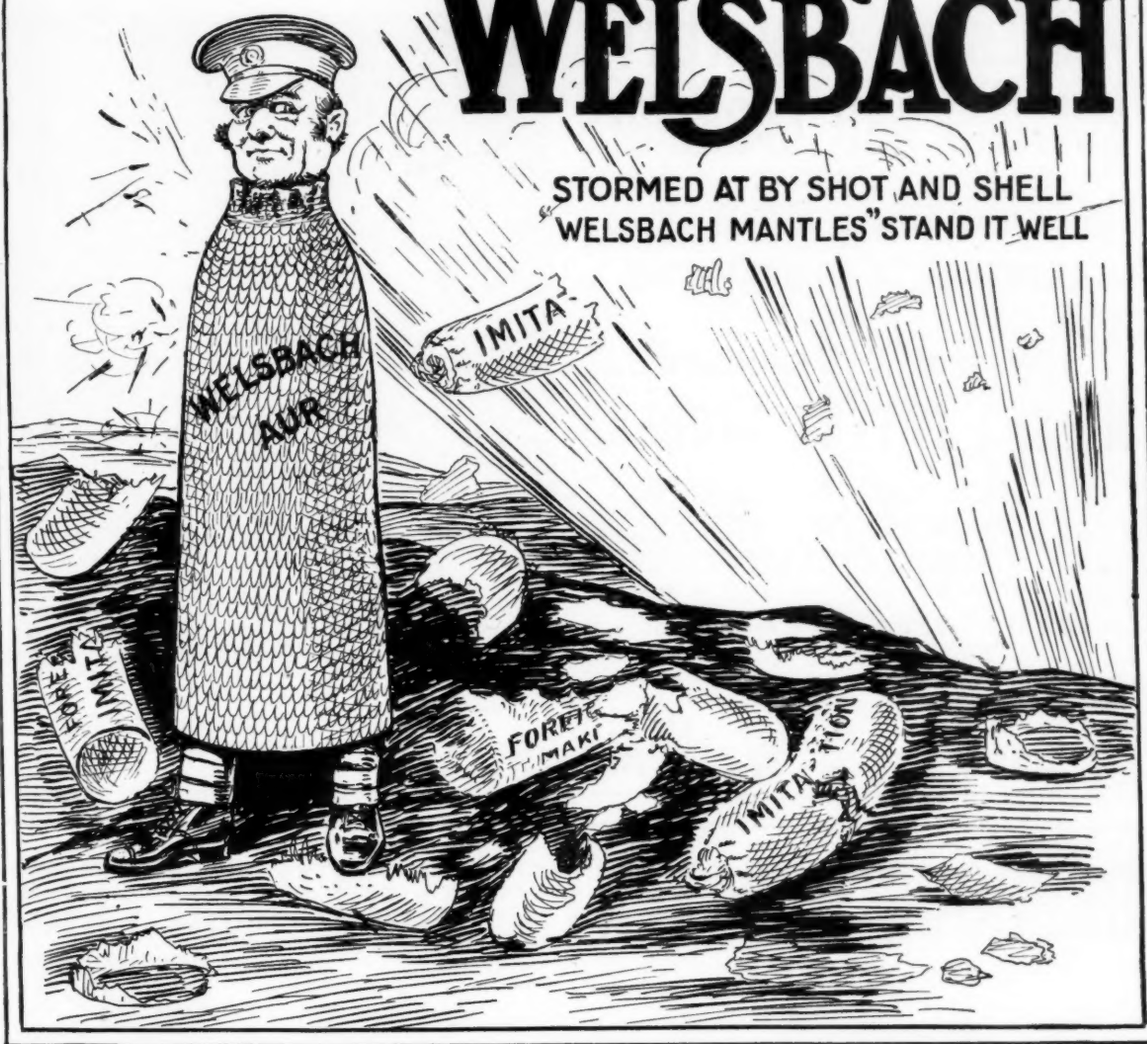
Burners for Welding.

M'GOWAN, R. R., of Lincoln.

No. 672; May 17, 1915.

This burner is intended particularly for welding seams in metal boiler flues, tubes, tyres, angle rings, T-rings, air reservoirs, flanges, and similar parts. The invention is described in the specification as applied to the type of apparatus comprising a supply pipe divided by a usual Y branch into two supply pipes. Upon the end of each is provided a burner—the burners facing towards one another and being adapted to be simultaneously applied to the joint upon opposite sides. A burner according to this invention comprises a box provided with a removable cover upon one end, and a recessed or channelled plate disposed within the burner-box, and adapted to be slid out from it through the open end when the cover is removed. The plate is provided at each side of the recess or channel with perforations through which the gases pass to be burned within a longitudinal slot in a block of refractory material secured upon the face of the burner-box. The gas (mixed with a suitable quantity of air) is supplied through the divided pipe to each of the burner boxes, and, escaping through the aperture therein, "burns fiercely in the longitudinal slot in the refractory material secured upon the opposing faces of the burners."

WELSBACH



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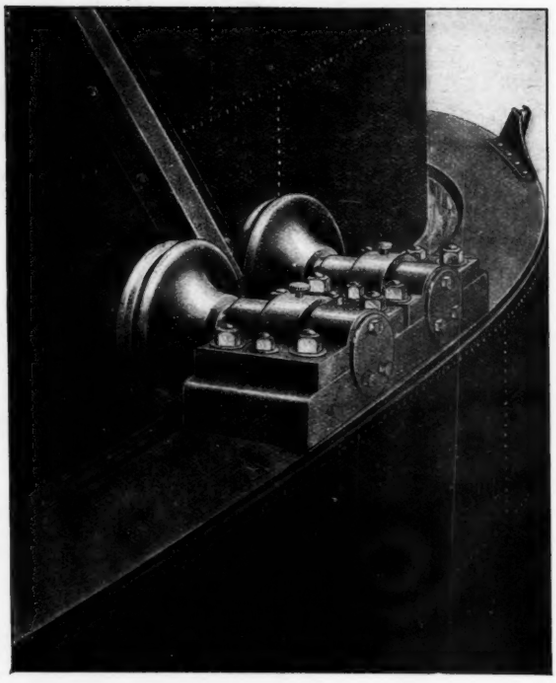

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PARLIAMENTARY INTELLIGENCE.

BOARD OF TRADE PROVISIONAL ORDER.

Long Eaton Gas.—In addition to the notices for the 1916 parliamentary session which were referred to last week, the Long Eaton Gas Company intend to make application to the Board of Trade for a Provisional Order to authorize them to acquire further land and construct additional gas and residual products works.

HOUSE OF COMMONS.

Nitrate of Soda.

Sir ARCHIBALD WILLIAMSON asked the Parliamentary Secretary to the Board of Agriculture what was the usual annual consumption of nitrate of soda as a fertilizer in the United Kingdom, and whether the consumption had increased materially during the last ten years?

Mr. ACLAND replied that the normal annual consumption of nitrate of soda in the United Kingdom was about 120,000 tons, of which it had been estimated that about two-thirds, or rather more, are used as a fertilizer. There was no evidence of any material increase in the consumption during the past ten years, but he hoped that, in view of the appeals made to farmers to increase the production of the land, there would be a substantial increase in the quantity of all kinds of fertilizers required during the present farming year, if adequate supplies can be made available.

Risks to Workers on Trinitrotoluene.

Replying to a question by Mr. Will Thorne, as to the health of workmen employed in the use of picric and nitric acids at Woolwich Arsenal, Mr. Lloyd George says he is informed that, as regards picric acid, no ill-effects are caused except a discolouration of the skin; but that workmen engaged on trinitrotoluene are sometimes injuriously affected, the degree of susceptibility varying greatly, many workers being immune. Various expedients of a sanitary and medical character are in operation to counteract the difficulty; and a weekly medical examination of all workers is carried out with a view to the transfer to other work of persons specially susceptible.

LEGAL INTELLIGENCE.

DARWEN "MUNICH" CHAMBER INSTALLATION.

German Contracts and the War.

At the West Riding Assizes, Leeds, last Wednesday, before Mr. Justice ATKIN, the hearing was commenced of an action in which Messrs. Joseph Morton, Limited, fire-brick manufacturers, of Halifax, claimed against Messrs. R. & J. Dempster, Limited, of Manchester, in respect of goods sold and delivered.

Mr. E. TINDAL ATKINSON, K.C., and Mr. MORTIMER were for the plaintiffs; Mr. F. NEWBOLT, K.C., and Mr. R. A. SHEPHERD were for the defendants.

Mr. TINDAL ATKINSON explained that in December, 1913, the Darwen Corporation proposed to erect what were known as "Munich" chamber ovens at their gas-works. The ovens were a Munich invention; and it was intended that another German firm, the Stettiner Company, should supply what fire-clay and other technical materials were required for carrying out the work. The defendants were to provide the ordinary iron constructional work. An agreement was entered into by the Darwen Corporation, the Munich people, the Stettiner Company, and the defendants to carry out the work. According to the agreement, it was to be done partly by the defendants and partly by the Stettiner Company. The defendants made themselves directly responsible for the completion of all the work between themselves and the Corporation; the Stettiner Company undertaking to indemnify the defendants against any failure to supply the defined quality and kind of material. When war broke out, the work had not been completed. The plaintiffs had been employed by the Stettiner Company to supply fire-clay material, mostly in the shape of bricks; and at the time that war broke out they had supplied a large quantity of material, valued at about £500. Just as the war started, the Stettiner Company sent a cheque for a sum of £250. But in consequence of the war the cheque was not honoured; and the plaintiffs had received no payment at all for any materials supplied to the Stettiner Company. The effect of the war was to dissolve contracts with enemy subjects; and the plaintiffs, if they had thought fit, could have refused to deliver any further goods for the undertaking for which defendants were responsible to the Darwen Corporation. He could not prove that any definite agreement or order was sent by the defendants to the plaintiffs; but when war broke out there were a number of German workmen on the works, employed by the Stettiner Company. The work might have been stopped; but the defendants, in order to ensure its being continued, undertook, as a matter of fact, to pay the wages of the workmen. This arrangement continued until October, when the German workmen were all duly interned. The defendants were receiving, and had, in fact, received, a large proportion of the £9000 they were entitled to get from the Darwen Corporation in respect of the work the Stettiner Company were expected to do. The defendants had £6000 of this sum in their hands, which they held as representing the amount of work done by the Stettiner Company, and further representing the amount of material the plaintiffs had put into the work. The defendants took up the position that they were neither morally nor legally liable to pay the plaintiffs any of the money which was represented by the delivery of the goods. The value of the bricks sued on as delivered after the outbreak of war was £264.

Evidence was given by the German Engineer of the Stettiner Company and Mr. A. H. Smith (the Darwen Corporation Gas Engineer).

Mr. NEWBOLT said this was an action for goods sold and delivered against the defendants, when they had a contract for similar goods with another party. This excluded any idea of an implied contract. His learned friend had omitted to say that the plaintiffs had got judgment against the Stettiner Company for all the bricks supplied before Aug. 1, and they had garnisheed in the High Court the money which the defendants were alleged to hold on behalf of the Stettiner Company, and an issue had been directed in the proceedings. Furthermore, the plaintiffs had based their argument upon ground which was altogether irrespective of the war. It had been said that the goods were delivered for work which the defendants were obliged to complete, and that the defendants had had the benefit of such goods. Therefore, if the goods were delivered on to premises where a contract was being completed, and a person got the benefit of them, that person was liable to pay the sub-contractor. This view was absolutely erroneous.

His LORDSHIP asked whether it was the case for the defendants that they were lending money to the German Company after the outbreak of war.

Mr. NEWBOLT: We were lending money to the agent of the German Company; and if he was acting lawfully as agent, then we were lending to the German Company. If he was not lawfully acting as their agent, then we were lending it to him.

His LORDSHIP, in giving judgment, said the contract was to be completed in a certain time, and the work was to be done in this country. Therefore it was now void, or suspended. It appeared to him that the contract during the war had been performed by the German Company, and for the reason of this one had only to look at the proclamations which were made from time to time under the Trading with the Enemy Act, which was passed immediately after the outbreak of war. The Act in itself, or the amending Act, was passed on Sept. 18, 1914, and contained certain prohibitions, one of which was not to trade or carry any merchandize from an alien enemy, or enter into any new commercial or financial obligation with any person in the German Empire. But this did not alter the common law; and it seemed to him that the contract should have been performed. This was the position so far as the German Company were concerned. If the parties had acted as they ought to have acted, they would have taken legal advice as to their position. It seemed, at any rate, that the plaintiffs were in doubt as to what should be done, because at some period after war broke out they communicated with the Darwen Corporation, as to what their position was; and Mr. A. H. Smith (the Gas Engineer to the Corporation) informed them that arrangements were being made by which they were to be paid by Messrs. Dempster. It was sufficient to say that they went on delivering the fire-clay bricks. Up to the date of the war breaking out the German Company carried out their part of the contract. They sent workmen over; but when war broke out it was illegal for Germans to continue the contract, and they were not in a position to make remittances. The men had to be paid; and so Mr. Diehl got into communication with defendants, and he asked for an advance. The defendants, in reply, wrote to him a letter in which they said they were arranging an advance on account of work done, and asked for a receipt. They sent sums of money for the payment of the German workmen; and in this manner the work was completed, so far as the fire-clay bricks were concerned. In this way, the defendants were able to perform their contract with the Corporation and discharge their obligation with that body. By reason of this completion, the defendants had secured payment from the Engineer to the Corporation representing the value of the work. As a matter of fact, they had been paid the full amount of the work, less 10 per cent. retention money. The money which had been paid them they had in hand at the present moment. In their own interests, in order to fulfil their legal obligation with the Darwen Corporation, the defendants took over the German workmen, paid them over sums of money, and used the materials supplied by the plaintiffs. If the defendants used the materials of the plaintiffs for their own advantage, and accepted them when they were delivered upon the land, then there arose in his mind an implied obligation to have to pay the price of them. This seemed to him what had actually happened in the case. The defendants tried to establish that the contract had not come to an end between the German Company and either the plaintiffs or the defendants. They said first of all this was a contract made with a branch of the German Company, and therefore the matter came within the terms of the proclamation dated Sept. 9, 1914, which provided where the enemy had a local branch, locally situated in British or neutral country, such a transaction would not be with the enemy. The German Company had sent over a number of workmen, under an engineer, for the performance of the contract; and he was satisfied upon the evidence that the German Company had no branch locally situated. Whatever the meaning of a "branch" was, it appeared to him it was not satisfied merely by a German Company sending over a number of workmen. It involved an office or workshop which could be said to be situated in this country. This it was said that the agency of Mr. S. N. Wellington, who was agent to the German Company, continued by reason of the law relating to the contract of agency. He was not to decide whether a contractural relation between the German Company and Mr. Wellington continued at all; but it concerned the question of the relationship of Mr. Wellington as the agent for the German Company. Their relations were covered by the law he had dealt with. It seemed to him, whether his contractural relations with the German Company continued or not, this would not help the defendants. It was suggested, further, that after the war Mr. Wellington in some way became principal of the German Company; but it would take a great deal to satisfy him that the relation did arise, that Mr. Wellington undertook to complete the contract or retain the right to complete the work. He had no evidence of this except that plaintiffs seemed to have from the beginning debited the goods to Mr. Wellington. He was satisfied that the goods were ordered, and supplied to the Company before the war broke out; and he did not see why after the war the relationship was changed as between themselves and the German Company, and Wellington became

to them a principal. If this was so, the defendants would have to say that, while the contract was being carried out by the German Company, when they were making advances of money, they were really lending money to an alien enemy for the purpose of enabling them to complete a contract which would entitle the alien enemy to be paid after the war a substantial sum of money. If this contention were really true, it appeared to him that it would amount to this—that the defendants were setting up, in fact they were committing, a breach of the law in reference to trading with the enemy, because it seemed to him quite plain that they would then enter into a financial contract for the benefit of the enemy. That would be like lending money to the enemy. They would be committing a plain breach of the law in this respect. He could not think that this was the true meaning of the transaction. To his mind, the whole transaction was that the defendants paid the workmen in their own interest, employing the workmen to complete the contract which the German Company were necessarily unable to complete, and that they would, after the war, adjust the remuneration so as to get the benefit of the completion of this part of the work. He doubted very much whether the plaintiffs or the defendants had at all carefully considered what the exact position was. He thought the plaintiffs were groping to some extent to find out what was the real position. He considered he was only doing justice to the defendants in inferring that they were not committing a criminal act, but were obliged in their own interests to complete a contract which they had entered into. The defendants had completed it; and, on accepting the goods for the purpose of completing it, it seemed to him they were under a contractural obligation to pay for the goods. He was all the more satisfied to come to this conclusion when he bore in mind that the defendants had banked the sum of money they had received from the Corporation, the very price of the goods for which they were sued; and they would otherwise hold it, till they were asked to account for it to the German Company at the close of the war. No question had arisen as to the price; and, in entering judgment for the plaintiffs with costs, he felt that the right price was the contract price.

Disputed Tar Contract.

Last Thursday, at the West Riding Assizes, Leeds, before Mr. Justice Atkin, the Cortonwood Collieries Company, Limited, brought an action in respect of goods sold to the Burnden Tar Company (Bolton), Limited. The defendants were not represented. His Lordship gave judgment, with costs, for the amount claimed, £158 17s. 4d.—the balance of an account for £458 17s. 4d., in reference to a contract entered into for the supply of tar.

Action for Personal Damage.

On Monday last week, in the High Court of Justice, King's Bench Division, Mr. Justice Darling and a Special Jury had before them an action in which Mr. J. A. Hutchison, the Managing-Director of the Burnden Tar Company (Bolton) and Hutchison's Limited, of Highbridge, Somerset, sued a Motor Company for damage to a motor-car and personal injury. The Jury returned a verdict for the plaintiff, assessing the damages at £200. But, inasmuch as the defendants had paid £422 into Court before the action was heard, judgment was entered for them with costs after the date of payment into Court—the plaintiff to have the costs up to that date.

Assault by a Gas-Works Labourer at Sheffield.

On Monday of last week, at the Sheffield Police Court, Arthur Kirkham, a labourer, was sentenced to a month's hard labour for an assault on Mr. Robert Neill, Works Manager at the Neepsend station of the Sheffield Gaslight Company. It was stated that the defendant was employed as a labourer, and for some time had been engaged in pouring pitch into granite sets. On the day before the assault, he saw Mr. Neill in the yard, and complained that he did not consider his job to be labourer's work. He then left. On the following day he went to the time office and told the timekeeper that he had come for his leaving certificate; and if it was not given him he would hit Mr. Neill on the nose. Mr. Neill refused him the leaving certificate, because he was wanted by the Company. Defendant then asked for a job; and the complainant said he would be taken back on the old conditions. Defendant said he wanted more money; and upon Mr. Neill remarking he had nothing to say on the point, defendant struck him with his fist in the mouth. Complainant lost three teeth, his upper lip was cut, and his nose very badly hurt. The Company regarded the assault as serious. Mr. Neill was also tired of the fine lines that workmen were drawing as to what was a labourer's work, and what was not. The defendant admitted that he had struck Mr. Neill.

Electricity Failure at Wednesbury.—During some portion of last Tuesday evening, Wednesbury suffered the not uncommon experience in places electrically lighted, of a failure in the supply of current. So far as business premises were concerned, alternative methods of illumination were promptly resorted to; but the inconvenience was greater in the case of many of the works turning out munitions of war, which take current from the generating station for lighting and power purposes.

Chertsey Gas Company.—The shareholders were congratulated upon the position of affairs revealed by the report which the Directors submitted at the annual meeting of the Chertsey Gas Company. The increase of 3d. in the price of gas which the heavy cost of coal had necessitated, compelled a reduction of ½ per cent. in all classes of shares which were under the sliding-scale; but under their Act, the dividend on the new capital was allowed to remain at 5 per cent. There was some diminution shown in the output of gas, owing to decreased consumption both in public and private lighting. The services of the Secretary (Mr. H. J. Hamilton) and of the Manager (Mr. F. G. Matthews) were acknowledged; the Chairman (Mr. W. Moir) remarking that the great difficulties encountered in securing delivery of coal had been overcome by the untiring energy of these two officials.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

In the report for the year ended June 30, which will be submitted at the meeting of proprietors next Tuesday, the Directors state that the balance at the credit of the revenue account at June 30, 1914, was £66,356. Since that date, the dividends paid have been: 7 per cent. on the preference stock, £14,000; 4 per cent. on the ordinary stock, £32,000. Adding to these supplementary income-tax £1202, and subscriptions to war funds authorized at the last general meeting £500, makes a total of £47,702—leaving a balance of £18,654.

In consequence of the adverse conditions arising out of the war, chiefly the unprecedentedly high freights to French and Italian ports, and the high cost of coal, no revenue has been received during the year in respect of the Company's large Continental interests. Consequently the greater part of the Company's capital has been unproductive. After adding such minor interests and dividends as were received, and deducting the management and pension charges and income-tax, the amount to be carried forward to next year is increased to £20,301.

The reasons which prevented the declaration of any dividends in respect of the Continental properties during the year, also caused the Cie. L'Union des Gaz to postpone the distribution of the final dividend declared by it in respect of the previous year, amounting on this Company's holding to £29,967, and included in the accounts for last year. In these circumstances, the Directors of the Continental Union Gas Company regret that they are unable to recommend the declaration of a dividend on either class of stock, in respect of the balance of £20,301 at the credit of the profit and loss account, which depends on the collection of the postponed dividend.

The report is signed, on behalf of the Board, by Mr. George A. Touche, as Acting-Chairman.

LEICESTER GAS-WORKERS' WAGES.

Some important questions concerning the remuneration of employees in the Corporation Gas Department were debated at the meeting of the Leicester Town Council last Tuesday; a suggestion being forthcoming in the course of the discussion that the responsible Committee were endeavouring to shirk their obligations in relation to a decision upon the subject of a war bonus by relegating it to a Special Committee.

There was no objection to the first portion of the Gas Committee's report, which was adopted upon the proposal of Mr. Hilton, seconded by Mr. Carver. This provided for an advance of 3s. a week during the war to the inspectors, stove fitters, and fitters' labourers working with engineer, and a 6 per cent. increase on the piecework prices of the purifier men. It was as to the rest of the report of the Committee that a sharp difference of opinion arose, the proposal which was submitted by Mr. Hilton concerning an application which had been received from the National Union of Gas Workers for a war bonus of 12½ per cent., and that time-and-a-half should be paid for Sunday work; there being also the further question raised as to granting a war bonus to the clerical staff. The Gas Committee, of whose recommendation Mr. Hilton moved the adoption, had suggested that a Special Committee should be appointed to deal with these several applications; but Mr. Murby proposed the reference back to the Gas Committee of this part of the report, with the proviso that any recommendation which they might adopt should be retrospective from the date of such recommendation. Mr. Salt seconded the amendment, entering a protest against the manner in which the matter was discussed and the brisk and careless way in which it was disposed of. Mr. Carter denied that the matter had been rushed through, and strongly supported the reference to a Joint Committee. Mr. Sherriff avowed that the Gas Committee dare not face the situation. The question was brought to the Council so that they might appoint a representative Committee and the whole responsibility be taken off the shoulders of the Gas Committee and placed on those of a Special Committee.

Mr. Hilton, in replying on the discussion, expressed his astonishment at the attitude certain members of the Gas Committee had taken up on this point. Mr. Murby and Mr. Salt were both present at the meeting of the Committee, when it was moved and seconded that the matter should be referred to the Council. The proposition was put, and he believed it was carried unanimously. Mr. Salt said he thought Mr. Hilton's memory failed him. They all discussed the matter, and at the close they were disgusted with the suggestion.

The amendment was negatived; the proposal submitted by Mr. Hilton being adopted, and a Special Committee, with the Mayor at its head, was appointed. An amendment, submitted by Mr. Kelly, that the Committee should consist of three members from each of the three sections of the Council, in addition to the Mayor, was defeated.

WEST BROMWICH GAS UNDERTAKING.

At a meeting of the West Bromwich Town Council last Wednesday, Mr. J. Brockhouse (the Chairman of the Gas Committee) referred to the communication from the War Office on the subject of benzol and toluol. He said he believed the Council and the public would sympathize with the Committee and the Manager (Mr. W. H. Johns) in the difficulties they were experiencing at the present time; and all they asked was that the consumers would be as considerate as possible with them. It had been made clear to them that the Government required all the toluol and benzol they could get; and though gas undertakings were not yet compulsorily made to extract these constituents, at most gas-works the process of elimination was in operation. The

effect of the extraction of toluol and benzol from the gas was to reduce its illuminating power; but in all the modern methods of using gas, this was unimportant. It was the calorific value of the gas which counted to-day. He advised those consumers who had not yet adopted incandescent burners to do so. He hoped people would be thoroughly patriotic in the matter, and would willingly submit to any inconvenience to which they might be put. Owing to the depleted staff through the war, it was not the intention of the Committee to take on any more consumers for maintenance at present.

NOTICES HANDED IN AT MARYPORT.

The Dispute Settled.

An application from the men employed at the Maryport Gas-Works for an increase of wages, backed up by notices handed in to cease work, has been met in an amicable spirit by the Council, with the result that the notices have been withdrawn.

The men asked for an all-round advance of 4s. per week. They are being paid trade union rates; stokers receiving 6s. per shift, and labourers 4s., *plus* a war bonus of 2s. or 3s. per week according to wage, and a production bonus of 1½d. per 1000 cubic feet made above a minimum of 22,000 cubic feet per shift. The Council felt they could not go beyond this, but granted some minor concessions; and as the notices had apparently been handed in under a misunderstanding as to the Council not dealing promptly with the matter, they were withdrawn. An advance was conceded for "pipe-jumping;" and all work will in future cease, or overtime commence, at noon on Saturday.

Stripping Town Gas for Benzol.—The action of the Government in securing the removal of those constituents from gas which are needed for making high explosives, led "J. O.," in the "Westminster Gazette," to refer to the stripping of town gas for benzol from the point of view of the motorist. He remarks that, "as an ordinary commercial enterprise, the plan was pretty hopeless; but now that national emergency has brushed all these obstacles away, it is not at all improbable that after the war the changes effected in the use of gas for illuminating and domestic purposes may lead to a reconsideration of the whole benzol question by gas undertakings, who may find it more profitable, after compensating consumers, to continue producing a substitute fuel for motor vehicles and for internal-combustion engines generally. The London gas-works alone are capable of producing 12 million gallons of benzol a year; but by taking the total output at 60 million gallons, and adding to it the roughly estimated 25 million gallons increase from the various new recovery plants since the war began, this would give us nearly all the fuel we need. In any case, however, we may reasonably expect that the increase in the benzol supply will be large enough to bring down the price of petrol."

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

At a meeting early this week of the Edinburgh and Leith Corporations Gas Commissioners, a communication was submitted from Mr. Stewart, the Secretary of the Edinburgh Branch of the National Union of Corporation Workers. This stated that a mass meeting of employees at the Granton works and outdoor staffs had passed the following resolution: "That we ask the Gas Commission to receive a deputation to consider—(1) the increase in wages of 1d. per hour to the employees; (2) an increase in wages to surveyors, also to put them on the same basis as the collectors' department; (3) that all increases should affect all employees called up for Government service; (4) that all men in the employment of the Commission under the heading concerned must join the Union within fourteen days of the deputation being heard, otherwise a ballot of strike will be taken; and (5) that increases in wages be retrospective from the original date of application." It was agreed to remit the matter to the Works Committee, with instructions to receive the deputation. Members were given to understand that by receiving the deputation they would not be prejudicing the question in any way.

At a sitting of the Glasgow Corporation Special Committee on Objections to Assessments, there were heard some appeals by owners against being charged at the usual rate of 15s. each light per annum for the lighting of private streets, courts, &c. In one case it was maintained that none of the lamps assessed for had been lit this winter; while in another it was stated that only two of them were lit. Mr. Alexander Walker, the City Assessor, said that the Act under which the assessment was charged set forth that owners in private streets and courts must provide proper lamps to the satisfaction of the Corporation Lighting Inspector, and that the Corporation were entitled to charge 15s. in respect of each lamp. If the lamps were not lit or not fully lit, a complaint should be made to the Town Council, who were the sole judges of the lighting requirements of the city. Mr. S. B. Langlands (the Lighting Inspector) stated that there were 6472 private lamps in the city; and of these 2584 were temporarily darkened in accordance with an order issued under the Defence of the Realm Act. Every year the Lighting Department had a deficit on these private lamps, of £3516. The cost of lighting each of these lamps was not 15s. as charged, but £1 12s. 5d. at present, owing to the war bonus and other charges. Appeals against the assessment had been made with regard to only 200 lamps out of the 2584 which were temporarily darkened. The Committee, after retiring, said, as the darkening was a temporary expedient under an order by the military authorities, they would continue consideration of the appeals until the middle of January. Instructions might be given at any moment releasing the order; and then the old order of things would be reverted to. Mr. Walker said that the effect of the decision might be to hold-up the whole of the owners,

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assessments in which private lighting was included. The Chairman (Treasurer M'Millan) said he hoped owners would have the good sense to pay their assessments, and trust to the Corporation to refund the money if the appeals were sustained.

The Paisley Town Council met on Monday to consider the situation arising out of a strike of gas workers for an increase in wages. Subsequently the following official statement was issued to the Press: "The whole of the employees in the Corporation gas-works quitted the service on Saturday, on the termination of their notice under an application for an increase of wages. In February, the retort-house employees received an advance of 2s. 2d. per week—thus bringing their average weekly pay to 39s. 3½d.; and in February and May last, the labouring section received an advance of 3s., bringing the weekly pay to 29s. In view of these increases, the Corporation early last week decided to refer the matter of further increases to arbitration by the Board of Trade; but this was unanimously rejected by the employees. The supply of gas to several important works in town manufacturing munitions of war, as well as the town generally, being in danger of stoppage, the Council appealed to, and claimed the protection of, the Ministry of Munitions of War and the Board of Trade; and they at once agreed to send all the men required for the conduct of the gas-works, many of whom have had gas-works experience. These all arrived in town on Sunday at 6 p.m. On Saturday evening, however, the Gas Committee decided to offer the labouring section a further advance of 2s. 6d. per week; and the men having been specially summoned to meet at the gas-works on Sunday morning, this offer was made to them, and was accepted. The retort-house employees still remain out, but will be re-installed if they agree to arbitration by the Board of Trade, who have already offered their services. Meanwhile, consumers should take care to use as little gas as possible."

The Dundee Town Council have declined to sanction an increase recommended by the Gas Committee [*ante*, p. 503] of ½d. per hour in the wages of the labourers employed by the department. Members failed to see any reason why the present rate of 6½d. per hour should be increased.

It was reported by the Gas Manager (Mr. A. Thomson), at a meeting of a Special Committtee of the Inverness Town Council last Tuesday, that, owing to the unsatisfactory manner in which a number of stokers were performing their duties and irregular time-keeping, there was great difficulty in maintaining the gas supply; and that unless better work was done, the supply might fail. It was stated in the course of a discussion that the best class of stokers are serving with the Colours; and it was agreed to approach the Government with a view to releasing them for purposes of re-instatement.

The second annual report has been issued of the Foremen's Association of the Glasgow Corporation Gas Department. The report, which is signed by the President (Mr. G. L. Scott) and the Secretary (Mr. Richard Liggett), sets out the work accomplished during the year. The Association is a branch of the Municipal Employees' Association; but, in addition to being a trade union, it has certain educative objects.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 6.

Freight rates for pitch continue to be forced up, which does not help business. Continental buyers, however, who require pitch are more inclined to accept the position if freight does not rise still higher. To-day's price can be called 20s. per ton, net, at makers' works. Creosote continues firm at 4½d. per gallon, net, in bulk; solvent naphtha, 90-160, is 2s. 2d. per gallon, naked—both at makers' works.

There has been a further improvement in the position of sulphate of ammonia; and there is a good inquiry both for prompt and forward. The value to-day is certainly £16 10s. per ton, net, filled into buyers' bags, at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Dec. 6.

There is no material alteration in the market for tar products. Business is very difficult to do in pitch; and though several parcels have been offered at low prices, the question of freight prevented the transactions going through. Creosote is very quiet, and reasonable prices are being accepted. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 9d. to 22s. 9d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅜d. to 2⅞d. Heavy oils, in bulk, 3⅜d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 4.

Notwithstanding the fact that the market for this material has now attained the highest level since 1883, the tone has been still more vigorous, and further substantial advances have been recorded during the past week. The action of the Board of Agriculture in reserving supplies for home consumption has doubtless affected the position, and foreign buyers have shown great keenness in securing supplies over the next few months. The nearest prompt values to-day are £16 12s. 6d. per ton f.o.b. Hull, £16 17s. 6d. f.o.b. Liverpool, and £17 2s. 6d.

VICTORY

After careful investigation, the British Admiralty has approved the adoption of DAVIS Gas Fires for the heating of the Gun and Searchlight Stations throughout the country, and none but DAVIS Gas Fires will be purchased for this purpose by H.M. Office of Works.

With Britain at War, what but the BEST could possibly satisfy Admiralty requirements?

f.o.b. Leith. For future delivery, it has transpired that £17 5s. per ton has been paid for January-March, £17 for January-June, and £16 10s. for January-December, f.o.b. at the principal ports.

Nitrate of Soda.

This market is firmer, and spot quotations have been raised to 14s. 7½d. per cwt. for ordinary quality, and 15s. 9d. for refined.

Sulphate of Ammonia.

From another source, it is stated that this market appears to be going higher, and some very good prices are reported to have been paid for prompt and forward. Outside London, makes are quoted at £15 5s.; Liverpool, £16 to £16 2s. 6d.; Hull, £15 15s.; Leith, £16 5s.; and Middlesbrough, £16 to £16 2s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The demand for coal is stronger, as is usually the case when the holidays are so near—at which time the production often increases. The shipments are fair in the circumstances of very high freights and a scarcity of tonnage. In the steam coal trade, the demand is strong for this season; and the prices for prompt supplies are firm. Best Northumbrian steams are from 20s. to 20s. 6d. per ton f.o.b.; second-class steams are 17s. to 17s. 6d. per ton; and steam smalls are a little firmer at 10s. 3d. to 12s. 6d. per ton f.o.b. There is not much coal free for sale for the rest of this month; and if the supply of shipping continues good, there is the probability of a full demand for some weeks to come. In the gas coal trade, the long contracts now claim a large part of the output. Thus, with a production reduced by enlistment, the market seems to be firm, especially for occasional cargoes for early delivery. Best Durham gas coals are 19s. 6d. to 20s. per ton f.o.b.; second-class gas coals are somewhere about 17s. to 17s. 3d. per ton; and for "Wear Specials," the quotation is now 21s. per ton f.o.b. The demand for coking coal is larger in Durham; and this has an effect on the gas coal trade and price. Although the rates of freight are abnormally high, gas coal is being rather freely exported, especially to France and some other Southern European countries. To London, the current freight on gas coal is as high as 16s. To Genoa (a large market for gas coal), as much as 61s. to 64s. is the current quotation; so that gas coal at that Italian port would be over £4 2s. per ton—a record value. Naturally this limits additional sales. In coke, the prices are firm all round. Gas coke is strong, though the production is now heavy, and good makes are from 27s. 6d. to 29s. per ton f.o.b., according to the quality. Exports appear to be heavier, both of gas coke and of foundry coke; but there are the same difficulties as to high freights and scarcity of steamers as affect the coal trade.

Torquay's Dark Streets.—Considerable dissatisfaction is expressed at Torquay over the decision of the Town Council not to light the street-lamps. The resolution of the Council took effect last week; and with the exception of a few lights on flights of steps and in other dangerous spots, the town was in darkness. Meetings of protest have been held by the Chamber of Commerce and by other bodies; and several memorials have been presented to the Council in opposition to what is regarded as the false economy of that body.

Shortage of Fireclay.—At a recent meeting of the Executive of the Miners' Federation, a letter was received from the Home Office suggesting that the Federation should consider the suspension of the Mines Eight Hours Act so far as it applies to fireclay mines. The Home Office communication pointed out that considerable difficulties were being experienced in connection with the manufacture of munitions by reason of the shortage in the supply of particular kinds of fireclay. It was agreed to write to the various districts in which fireclay mines are situated, asking for the fullest information as to how the matter stands. It was decided that a conference of the Federation should be convened to consider the matter.

Exmouth Public Lighting.—At a meeting of the Exmouth Urban District Council last Wednesday, the Committee appointed to deal with the accounts of the Exmouth Gas Company with regard to the public lighting, reported that Mr. W. E. Dean (the Secretary of the Company) had written saying the Directors had been advised by eminent Counsel that, owing to the order prohibiting public lighting, the contract between the Council and the Company was dissolved. The only outstanding matter awaiting settlement was the amount to be paid by the Council down to the date of the order for extinction. The Committee recommended that a cheque be sent to the Company for £30 for gas supplied to May last, accompanied by a letter stating that they did not admit the contention that the contract was dissolved, but holding that it was merely suspended until the order was revoked. The payment was therefore made without prejudice to any other question between the Council and the Company arising out of the contract.

Municipal Undertakings and the Excess Profits Duty.—It was stated at a meeting of the Manchester Corporation Parliamentary Sub-Committee that they had had under consideration that portion of the Finance Bill dealing with the excess profits duty, and had adopted a resolution expressing the opinion that enterprises owned and carried on by municipal authorities should be excluded from the operation of the Bill; "and if for sufficient reason that is considered undesirable, then alternatively that the several undertakings of a municipal corporation should be consolidated and treated as one trade or business—the excess profit duty being charged on the total profits after deducting the total losses." Setting out the average profits of the best two pre-war trade periods, and comparing these with the returns in respect of 1915, it was shown that the excess items for this year equalled £15,493, and the decreases £134,195—thus showing a net falling off, as compared with the average of the best two pre-war trade years, of £118,702.

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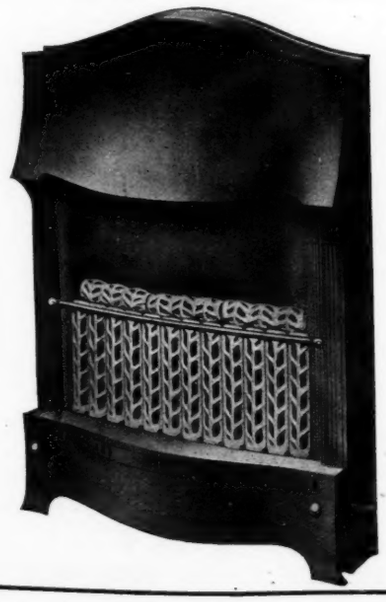

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Quality of Burnley Gas.

At the meeting of the Burnley Town Council last Wednesday, there were numerous complaints about the quality of the gas supplied, and the insufficient lighting of the street-lamps. Alderman Emmott (the Chairman of the Gas Committee) acknowledged that complaints were regularly being made, and that they were likely to continue having them. The Government were asking them to do "certain things" with the gas; and this brought down the illuminating power to some extent. By doing this, they also had greater trouble with naphthalene in the pipes. He admitted the gas was not as good as they would like it; but he believed they all wanted to help the Government in the war, and to do this they could not make the same quality of gas as usual. He advised householders to regulate their incandescent burners, and to ask for a gas employee to attend to their cookers when out of order. It was also difficult to get coal; but they were doing their best, and would have to put up with it. This explanation seemed to amply satisfy the critics.

Increase in Price at Wallsend.—The Walker and Wallsend Union Gas Company intimate that after the completion of the December meter readings the price of gas will be increased from 2s. 5d. to 2s. 7d. per 1000 cubic feet.

A Leaky Gas-Pipe at Bargoed.—Evidence given at an inquest on a Bargoed miner, showed that deceased was found in bed frothing at the mouth and blue about the lips; the room being full of gas. The man's father and other relatives had smelt gas escaping in the house the previous week, and notified the Rhymney and Aber Valleys Gas Company of the leakage. The Company's officials made an inspection, and opened up the main. It was proved by an employee of the Gas Company that there was a leakage in an old pipe in front of the house which had been laid over thirty years ago; and it was concluded that the escaping gas went into the house. No gas was used in the house. A doctor said deceased died in consequence of inhaling coal gas, causing bronchitis, which eventually developed into pneumonia. A verdict to this effect was returned.

Colchester Gas Bill.—A Special Committee has been appointed by the Colchester Town Council to consider the proposals contained in the Bill which the Gas Company are promoting. In moving that such a Committee be appointed, Mr. Potter, while disclaiming any hostility to the Company, remarked that the undertaking was a monopoly, and that the question of the supply of gas on equitable terms was of great importance to the town. He criticized at some length the clauses of the Bill. Alderman Benham said he was sure everyone would agree that the proper course was to appoint a Committee to watch the interests of the Corporation. He was rather sorry that Mr. Potter, with the limited knowledge at his disposal, had made certain remarks which showed that he was not fully conversant with the proposals of the Company. Nothing would be done to at all prejudice the interests of the consumers.

Darlington Loan Sanctioned.—The Darlington Corporation have received the sanction of the Local Government Board to the borrowing of £6807 for purifiers and a station-meter at the gas-works, and £393 for mains, to be repaid within periods not exceeding twenty years and thirty years respectively.

Suicide by Gas.—In the course of an inquest at West Hartlepool, on the body of Ellen Sanders, the wife of a labourer, it was stated that since receiving the news of her son's death at the front she had been always upset. One day last week, her husband found her dead with her head and shoulders on the kitchen table. A gas-pipe attached to a small bracket had dropped by her side. The Jury returned a verdict of "Suicide during mental depression due to grief."

Water Supply of Buenos Ayres.—The report of the Province of Buenos Ayres Water-Works Company for the year ended June 30 states that the profit amounted to £33,317 (against £30,654); and the balance brought forward was £5644. The Directors recommend a final dividend on the ordinary "A" shares of 4 per cent. actual for the six months ended June 30; and out of the balance of £20,700 the contribution to the amortization account is £5000. The reserve account is credited with £1000; there is written off expenses of issues of capital £4000; and the balance carried forward is £8261.

South Metropolitan Co-Partnership Accounts.—The current issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company contains the co-partnership accounts for the year ended June 30 last. These show that the withdrawable bonus for the twelve months amounted to £18,172, and the trust bonus, for the purchase of stock, to £18,588. A statement covering the period from the start of the scheme in 1889 to June last indicates that the total bonus has reached £728,358; and the total cash savings, in addition, £242,487. There has been a sum of £268,589 voluntarily placed in stock, in addition to withdrawable bonus put direct to trust account. The amount transferred from the withdrawable account to the trust account for stock is £213,378; and to this is added the portion of the bonus credited to the trust account (£363,771), and savings and interest, making the total receipts on this account £627,163.

Exeter Public Lighting Contract.—The Lighting Committee of the Exeter City Council reported, at their meeting last month, that they had gone carefully into the question of the charges to be made by the Gas Company in view of the reduction of lighting. The existing contract covered not only the cost of lighting, but the painting, cleaning, and other maintenance of the lamps; and it was pointed out by the Company that the contract price had been arrived at on the assumption that the full number of lamps would be lit, and that all capital charges would continue. The Company offered to allow from the charge per lamp the saving effected by the reduced lighting. This would mean a reduction in respect of the unlit lamps of an annual sum varying from £1 3s. 6d. to £3 16s. 6d. per lamp, extinguished or reduced. The Committee recommended this as an equitable arrangement; and the Council adopted it.

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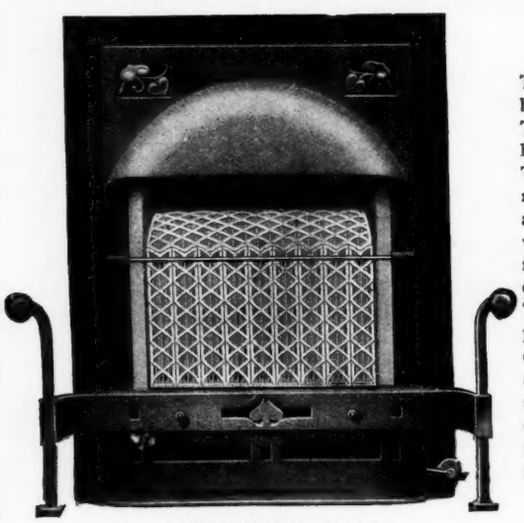

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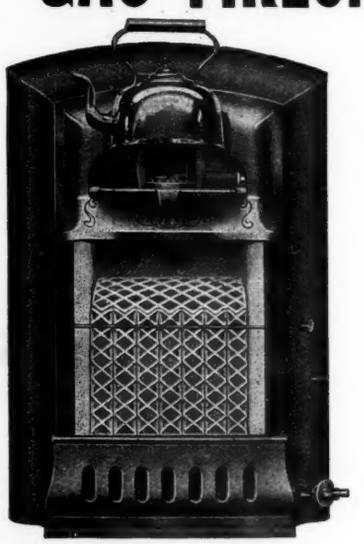

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Gas Cheaper than Coal.—A post-card is being sent by the Southend Gas Company (of which Mr. C. S. Shapley has recently been appointed Engineer and Manager) to all householders in their area, calling attention to the fact that "Gas is Cheaper than Coal." People are urged to practise war time economy by using gas for cooking, and to save labour by employing gas-fires. It is pointed out that saving in expense is effected by using gas in preference to coal at its present high price, and that Southend gas is the same price to-day as it was before the war. The Company offer expert advice to all who desire it in respect to cookers and fires.

Road Repairs and Openings for Mains.—Referring to difficulties which are sometimes experienced over the breaking-up of roads, owing to the fact that gas, water, and electricity supplies are under different control, which prevents the doing of necessary work in each case at the same time, the "Autocar" says that similar trouble has been experienced in the United States, in one part of which—Manhattan—the authorities are making an attempt to cope with it. The plan adopted is that, when it is proposed to pave or re-pave a thoroughfare, a notice is exhibited prominently in the particular road or street stating that "street openings required for water, steam, gas, or electricity should be made at once, as this street is about to be paved, and no pavement cut will be allowed for one year."

A Leaving Certificate Refused.—An application was made to the Munitions Tribunal at Newcastle-on-Tyne, by Arthur Woodcock, an employee of the South Shields Gas Company, for a leaving certificate, on the ground of his having obtained a better position with the local Co-Operative Society. He was receiving only 24s. a week at the gas-works, while his new employers were giving him 37s. 6d. a week, with a promise of 40s. Mr. T. H. Duxbury, the Gas Company's Engineer, stated that they were engaged on munitions work, and could not spare the man. As a matter of fact, they were seriously hampered by the shortage of labour. The Chairman remarked that the Co-Operative Society were running very serious risk in taking the man away from the Company's employment, seeing that he was a munition worker. The certificate was refused.

Public Lighting Charges in Reading.—A further reduction in the amount charged for street lighting is being made by the Reading Gas Company. Last August an allowance at the rate of £750 a year was offered, and now the Company have added to this another £250, making a total annual allowance of £1000. This increased allowance is to be subject to the following conditions: That the Corporation agree to extend the period of the existing contract for not less than one year and for any period after that one year during which the reduced lighting lasts; that the Corporation agree to pay during such extended period or periods the same charge per lamp as they are now paying, subject to any increase or decrease which may be made in the charge consequent on any increase or decrease which may be made in the price of gas under the terms of the contract; that this offer is made without prejudice to the terms of the contract with the Corporation.

Tests Discontinued at Worthing.—Acting on the suggestion of the Ministry of Munitions, the Finance Committee of the Worthing Town Council have patriotically resolved that tests of the gas shall be discontinued during the war. The matter, of course, arose out of the letter which had been sent by the Ministry to local authorities pointing out that, in the existing circumstances they should do everything in their power to prevent attacks being made on gas undertakings owing to any possible deterioration in the quality of the gas supplied, either by ceasing to test the gas altogether, or at any rate by preventing the results of the tests being made public.

Gas to Replace Electricity in Belfast.—The Belfast City Council have agreed to a proposal to substitute gas for electricity in the central area of the city, with the object of relieving the pressure upon the electricity supply. Dr. Williamson said that, owing to the supply of electricity being short, it was thought, in the interests of the ratepayers, the electric lighting of the streets might for the present be supplanted by gas. Mr. Curley, while admitting that the Gas Committee were able to do lighting much cheaper than could be done by electricity, regretted the sacrifice of the £1500 which the Corporation had spent during the last four years in putting up the electric lamps.

Naphthalene Trouble at Sowerby Bridge.—In common with other districts, the Sowerby Bridge Council have received a letter from the Ministry of Munitions of War requiring makers of gas to scrub their gas in such a manner as the Minister may direct. The letter added that "as Sowerby Bridge are already scrubbing their gas by the 'C' process, this notice is given in order to protect the Council in the event of complaints being made that the quality of gas has deteriorated." At the meeting last week, Mr. J. W. Whiteley said the lights were certainly poorer; but the real cause was naphthalene in the mains. The Council were doing their best to overcome this trouble. He appealed to the public, through the local Press, to bear with the Council in the work they were doing for the good of the country.

Increased Water Consumption in Birmingham.—The "Engineer" reports that, owing to the industrial activity in Birmingham, particularly with regard to munition work, the demand on the resources of the Water Department has been abnormal for some time past. This period of the year is generally the quietest; but the quantity of water now being consumed, for the reason stated, is unusually large. For instance, on Tuesday, the 16th ult., the consumption was 29 million gallons; whereas the supply from the Welsh aqueduct at the maximum is only equal to 25 millions per day. Consequently, the stand-by sources have again been called upon; and the result is that in certain districts the water is harder than is normally the case. The distribution of the mixed water cannot prevail all over the city, as it must be confined to districts where the stand-by sources are connected. Complaints of hardness of the water are likely to be rather frequent until the third pipe is provided for bringing more water from Wales. This third pipe is in contemplation, and but for the war the work would have been commenced last summer.

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Gas and Electrical Publicity Methods.

In the course of an article urging the need for more spirited competition on the part of electrical manufacturers, the "Sanitary Record" asks whether they are putting forth the same efforts as the manufacturers of gas fires, lamps, and fittings, and then proceeds: "We fear not. Those interested in the gas industry are pushing their wares with rare spirit, originality, and enterprise. They are going tooth and nail for their potential buyers—the public—and, by means of advertisements, exhibitions, pamphlets, demonstrations, and lectures, are leaving no stone unturned to bring the virtues of gas lighting, heating, and cooking to their notice. How do the electrical manufacturers stand in this matter? Their announcements rarely appear outside their own trade journals, which municipal officials and the public, for obvious reasons, do not read; and as for exhibitions, demonstrations, and other effective means of publicity, if they do take place, the public knows nothing of them. From whatever point of view one looks at this curious inertia on the part of electrical firms, it seems fairly clear that, in the race for popularity, gas is likely to win all along the line, unless the electrical firms wake up and pursue a wholly different and more enterprising line of action."

Gas Complaints at Tipton.—It was stated by Mr. W. Doughty (the Chairman of the Gas Committee), at a meeting of the Tipton District Council last Tuesday, that the new gas plant was now nearing completion; and he hoped in a few days' time gas better in quality and greater in quantity would be supplied. Mr. Lyons thought the consumers should have a reduction in price under the circumstances. Mr. Powell complained of the constant fluctuations of pressure. Occasionally, he said, the lights went out altogether; and then the gas escaped. Mr. Salter remarked that he had heard many complaints about the gas, and had personally lost considerably through the alterations of pressure.

Gas Troubles at Neath.—Referring to a paragraph published in its pages reporting an unsatisfactory condition of the lighting of Neath, the "South Wales Daily News" say that they learn from Mr. W. C. Jackson (the Gas Manager) that for several months, owing to special conditions of extracting certain bye-products, there has been an inevitable reduction in the illuminating quality of the supply. On the day in question, the water-pipe supplying the retort-house burst, owing to the frost; and this further depreciated the quality of the gas. The reason for extinguishing a portion of the street-lamps has been economy, and has nothing to do with the improvement of the gas supply. The Committee, no less than the Manager, are fully alive to these matters—especially the necessity of dealing with the naphthalene trouble. Plant has been ordered to meet the last-named difficulty; and when this has been delivered and put into operation, Mr. Jackson feels confident the troubles will be at an end.

The City of Leeds have placed an additional order with Messrs. Alder and Mackay, of Edinburgh, for the supply of 500 of their "A. & M." patent pressure-wave automatic controllers.

Among the latest devices suggested to assist pedestrians who are unfortunate enough to find themselves abroad in unfamiliar localities after dark, is a cast-iron illuminated box to lie embedded in the vertical face of the kerb, showing the name of the street.

Mr. H. Claude Classing, of No. 79, Wiltshire Road, Brixton, S.W., has been appointed representative for Great Britain of the General Gas Light Company, Kalamazoo (Mich.), U.S.A., the manufacturers of the "Humphrey" gas lighting specialities.

The Wholesale Fittings Company, Limited, Commercial Street, E., forward a copy of their catalogue for the season 1915-16. Burners, mantles, and sundries are listed; and there are also sections devoted to brackets, pendants, beaded fringes, and glassware (including the "Silcbrome" brand of French hard glass).

At a meeting of the Spenborough District Council last week, it was reported that the Council and the Bradford Corporation had agreed to appoint Mr. G. J. Talbot, K.C., as Arbitrator in the matter of the proposed revision of terms for the supply of water in bulk by Bradford to the Spenborough Council's district.

The Ardwick Urban District Council, having been refused sanction by the Local Government Board to borrow money to finance a new water scheme, have decided to proceed with a modified scheme, to cost £1376, which will involve no increase in the rates, but will be paid for out of earned income by economies in other directions.

Reporting on the suggestion of the Ministry of Munitions that councils should do everything in their power to prevent attacks on gas undertakings owing to possible deterioration of the gas supplied, and that this could best be done by ceasing to test gas altogether, or by preventing results of tests being made public, a Committee of the Wandsworth Borough Council say: "We do not think it advisable to discontinue tests altogether, but propose to arrange for fewer tests at a proportionately less cost to the Council."

APPLICATIONS FOR LETTERS PATENT.

16,418.—Helps, G., "Gas-ovens." Nov. 22.
16,487.—Leigh, A. G., "Gas-turbine." Nov. 23.
16,497.—Gibbons Bros., Ltd., and Masters, R., "Continuous annealing furnaces." Nov. 23.
16,526.—White, A. E., "Coal-gas generating." A communication from the Riter-Conley Manufacturing Company. Nov. 23.
16,577.—M'Dowall, T. R., "Combined gas fire and cooker." Nov. 24.
16,634.—Davison, E. J., and Tooley, C. P., "Chequer-bricks of water-gas plants." Nov. 25.
16,673.—Tully, C. B., "Gas-producers." Nov. 25.
16,696.—Dempster, R. & J., Ltd., and Beard, G. F. H., "Governing-means for gas under pressure." Nov. 26.
16,711.—Keith, J. & G., "Gas-furnaces." Nov. 26.

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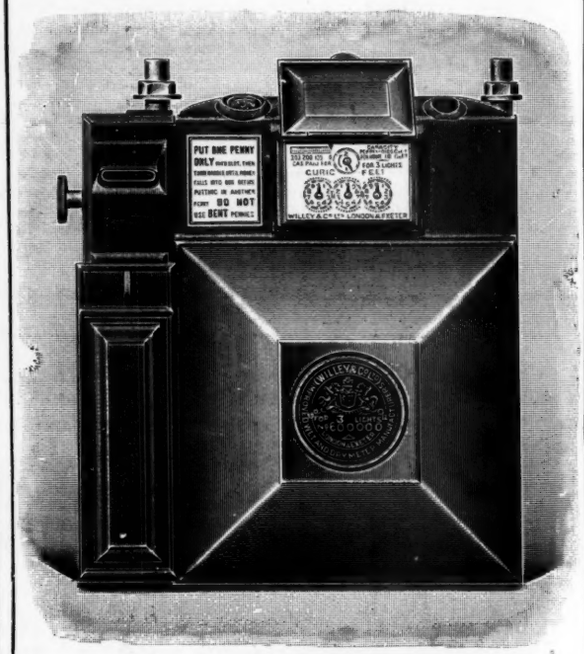

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STOCK MARKET REPORT.

THE Stock Exchange has had a rather slack week, and, on the whole, a duller one than those we have recently been accustomed to. Various factors, mostly of the usual character, have operated to produce this effect. The considerable advances made in some lines have been followed by realizations to seize profits. This was apparent in Government securities, and conspicuously so in War Loan and Consols; and it is said that a good deal of the proceeds has moved in the direction of the French Loan. The prospectus of this has caught on very well; but, in the opinion of some, there are one or two points which need some further elucidation. Americans were down; and Canadians marched with the market. But in the latter case, the remarkable traffic returns, and the recognized signs of assured prosperity, forbade a continued decline; and before the close they had established firmness. Home Rails were irregular. The Foreign Market was to an extent in similar vein; but Japanese and Chinese in the East, and South Americans in the West, were still attractive. South Africans were unmoved, and showed considerable power. Strong lines were apparent in the Miscellaneous group; the enormous demand for freightage pushed all shipping shares up; rubber recovered from its set-back; and Bank shares were in request. The published accounts of some more undertakings producing warlike material and appliances show big war profits. The Banks are not going to take the projected attack upon their half-commission lying down, and hint at possibilities of retaliation, in which event the assailants might come out losers. Perhaps the whole thing may fizzle out. The early closing at 3 o'clock by the Banks began on Wednesday, and nobody seems to have suffered at present. Business in the Gas Market was a good deal quieter, and presented no very marked feature. Movements—such as they were—were not uniform. Very little was done in Gas Light and Coke. Some issues were wholly untouched; and the ordinary was rather easier. South Metropolitan, though very quiet, was firmer. Imperial Continental made a slight advance to 85. The Money Market was quite easy.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 74, 74⅜, 75. Imperial Continental 77. Liverpool 93½. On Tuesday, Brighton and Hove "A" 124½, 125¼, Gas Light ordinary 74, 74⅜, Imperial Continental 80. On Wednesday, Brighton and Hove "A" 125, 125½. Gas Light ordinary 74, 75, Liverpool 93½, South Metropolitan 78½. On Thursday, Brentford debenture 75, 75½, Gas Light ordinary 74, 74⅛, 74¼, 74⅜, Ilford "B" 99½, 100, Imperial Continental 83¼, 83½, Primitiva preference 3⅝, 3 11/16, Tottenham "B" 96½, 96¾. On Friday, British debenture 72, 72½, Gas Light ordinary 73⅞, 74, 74⅛, 74⅜, 74½, ditto preference 73½, Imperial Continental 83½, 84¼, Primitiva preference 3⅝, San Paulo preference 8¾, South Metropolitan 78, 78½, 79. On Saturday, Gas Light ordinary 74¼, Imperial Continental 85, Primitiva preference 3 11/16.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59– 64	3 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76– 79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5¼–6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c.	29– 30	5 6 8	..
878,480	10	,,	7	7/-	B 7 p.c.	15–15½	4 10 4	..
95,000	10	,,	6	6/-	Pref. 6 p.c.	13½–14	4 5 9	..
147,210	—	—	—	4	Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	16/-	Brentford Consolidated	261–266	5 5 3	..
330,000	,,	,,	†11	55/-	Do. New	204–209	5 5 3	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref.	109–111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91–93	4 6 0	75–75½
217,380	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208–218	5 3 4	..
244,200	,,	,,	8	7½	Do. A Ord. Stk.	154–159	5 0 8	124½–125½
530,000	20	Mar. 26	12½	22/6	British	44–45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88–90	4 8 11	72–72½
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85–87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¼–2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4–6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70–75	6 0 0	
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108–110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106–108	5 1 2	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103–105	5 1 6	..
475,000	,,	June 11	8	3	Do. 3 p.c. Deb. Stk.	69¼–71½	4 8 11	..
900 000	Stk.	,,	4	4	Continental Union, Ltd.	76–79	5 1 3	..
900 000	,,	,,	7	7	Do. 7 p.c. Pref.	116–118	5 18 8	..
278,4?0	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
4?2,270	Stk.	—	6	6	Derby Con. Stk.	123–125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102–104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½–18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord.	98–102	4 16 6	73½–75
2,600,000	,,	,,	8½	3½	3½ p.c. max.	76–79	4 8 7	..
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96–99	4 0 10	73½
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72¼–74½	4 0 6	..
130,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	6	4½	Hastings & St. L. 3½ p.c.	87–89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼–16⅞	6 11 4	..
86,603	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½	7½	Ilford A and C	151–154	5 2 4	..
65,790	,,	,,	6⅜	6½	Do. B	115–118	5 8 0	99⅝–100
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92–94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150–160	5 12 6	77–85
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84–86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119–121	5 7 6	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. { A	211–213	4 18 11	93⅛–18½
718,100	,,	,,	7		B	146–148	4 14 7	
309,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	4/-	Mana & Mediterranean Mes. of	4½–4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Melbourne 4½ p.c. Deb.	99–101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½–12	6 13 4	..
1,775,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½–99½	4 10 6	..
529,705	Stk.	June 26	3¾	3¾	Do. 3½ p.c. Deb.	82–83	4 4 10	..
55,940	10	Feb. 26	7/14/6	7/8⅝	North Middlesex 7 p.c.	14–15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117–122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼–7⅜	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Inland B	128–131	4 19 8	..
100,000	50	,,	19	60/-	Do. C	118–121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
349,980	5	April 29	8	—	Primitiva Ord.	5½–6	6 18 4	..
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅝–5	5 0 0	3⅜–3 11/16
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91–93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85–87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½–11	5 9 1	8⅞
125,000	50	July 1	5	5	5 p.c. Deb.	47–49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223–224	4 9 8	..
209,984	,,	,,	10	10	Do. B	222–224	4 9 8	..
523,500	,,	,,	10	10	Do. C	220–222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½–11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4,0	44/-	South Met., 4 p.c. Ord.	111–113	4 16 8	78–79
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½–74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157–159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114–116	5 3 8	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110–112	4 9 3	..
135,000	,,	—	—	48/4	Do. West Kent.	..	—	..
137,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116–118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99–102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c.	135–138	5 8 8	..
742,275	,,	,,	6	6	B 3½ p.c.	115–117	5 2 7	96½–96¾
181,255	,,	June 26	4	4	4 p.c. Deb.	87–89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5–6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93–95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½–109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8¾	78/9	Wandsworth A 5 p.c.	151–156	5 7 4	..
255,636	,,	,,	6¾	63/9	,, B 3½ p.c.	129–134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110–115	5 2 0	..
359,000	,,	,,	6¼	57/6	Wimbledon 5 p.c.	117–122	5 0 5	..
98,000	,,	,,	6¾	63/9	Epsom 5 p.c.	121–126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66–69	4 6 11	..

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Sealed Tenders, endorsed "Tender for Fire-Clay Goods," addressed to the Chairman of the Gas Committee, must be Delivered at the Gas Offices, Town Hall, Manchester, not later than 10 a.m. on Thursday the 9th day of December, 1915.
The Gas Committee do not bind themselves to accept any Tender, and reserve to themselves the right to divide any Offer as they may deem advisable.
By order,
THOMAS HUDSON,
Town Clerk.
Town Hall, Manchester,
Dec. 1, 1915.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

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